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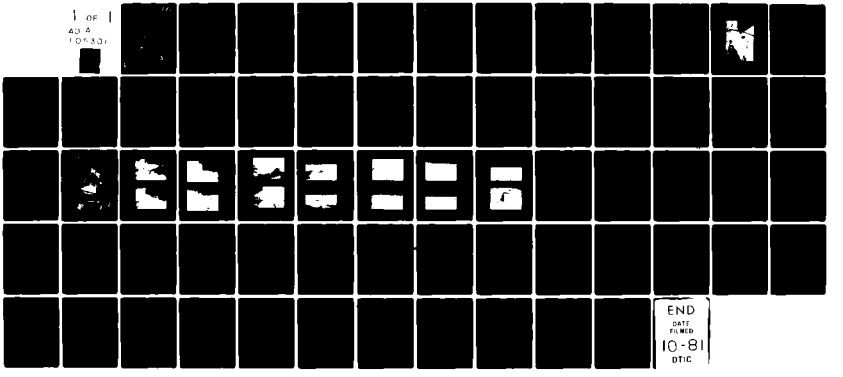

LEVEL II

MISSOURI-NEMAHA-NODAWAY BASIN

AD A105301

KELLER LAKE DAM

ANDREW COUNTY, MISSOURI

MO. 11608

PHASE 1 INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

United States Army
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St. Louis District

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PREPARED BY: U.S. ARMY ENGINEER DISTRICT, ST. LOUIS

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3. RECIPIENT'S CATALOG NUMBER	
4. TITLE *(and Subtitle)* Phase I Dam Inspection Report National Dam Safety Program Keller Lake Dam (MO 11608) Andrew County, Missouri	5. TYPE OF REPORT & PERIOD COVERED Final Report.
	6. PERFORMING ORG. REPORT NUMBER
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9. PERFORMING ORGANIZATION NAME AND ADDRESS U.S. Army Engineer District, St. Louis Dam Inventory and Inspection Section, LMSED-PD 210 Tucker Blvd., North, St. Louis, Mo. 63101	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
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Dam Safety, Lake, Dam Inspection, Private Dams

20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

This report was prepared under the National Program of Inspection of Non-Federal Dams. This report assesses the general condition of the dam with respect to safety, based on available data and on visual inspection, to determine if the dam poses hazards to human life or property.

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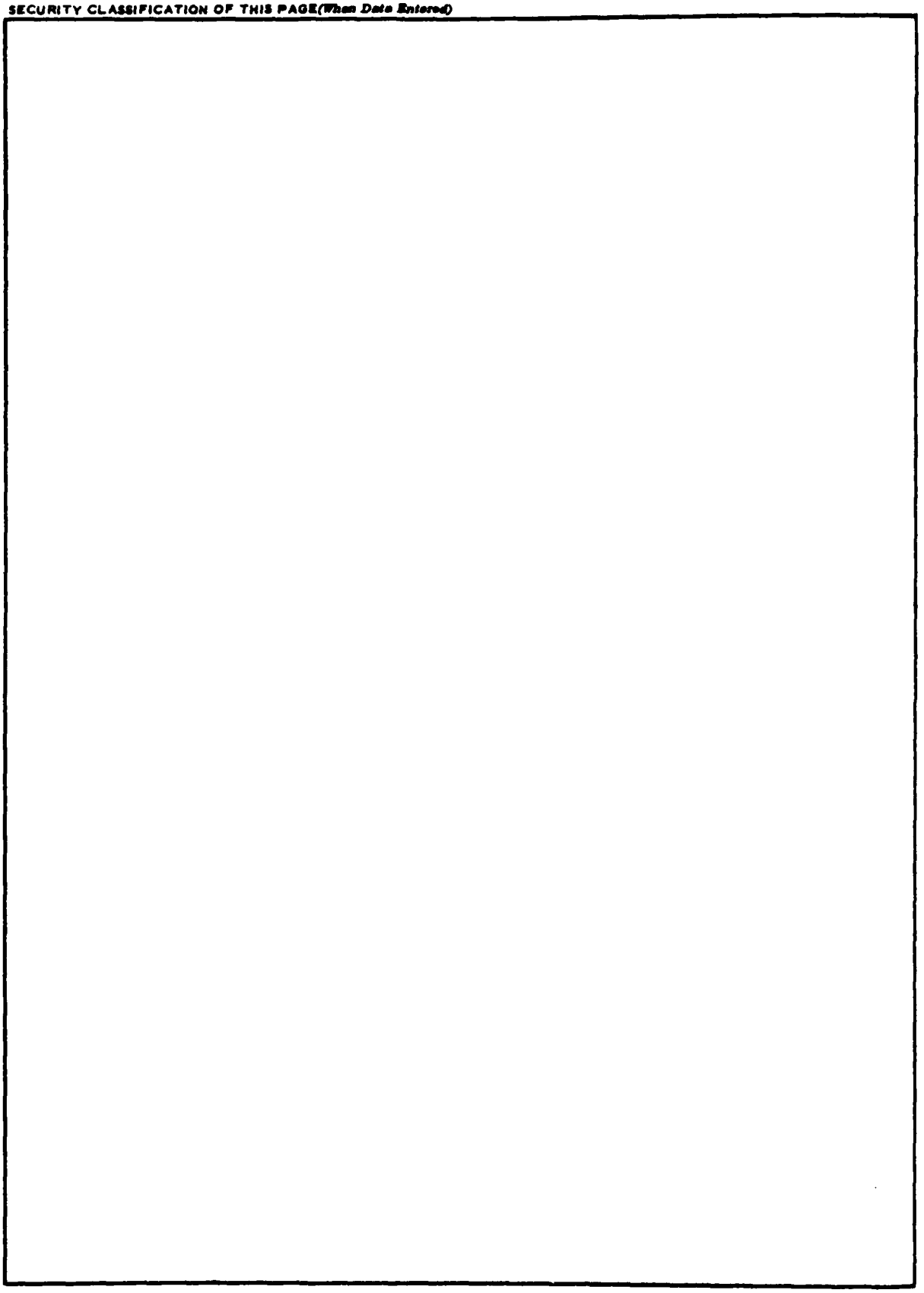

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KELLER LAKE DAM
ANDREW COUNTY, MISSOURI
MISSOURI IDENTIFICATION NO. MO.11608

PHASE I INSPECTION REPORT

NATIONAL DAM SAFETY PROGRAM

PREPARED BY
HOSKINS-WESTERN-SONDEREGGER, INC.
CONSULTING ENGINEERS
LINCOLN, NEBRASKA

UNDER DIRECTION OF

ST. LOUIS DISTRICT, CORPS OF ENGINEERS

FOR

GOVERNOR OF MISSOURI

JUNE, 1980

DEPARTMENT OF THE ARMY
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
210 TUCKER BOULEVARD, NORTH
ST. LOUIS, MISSOURI 63101

REPLY TO ATTENTION OF

SUBJECT: Keller Lake Dam - MO 11608

This report presents the results of field inspection and evaluation of the Keller Lake Dam. It was prepared under the National Program of Inspection of Non-Federal Dams.

SUBMITTED BY: SIGNED
Chief, Engineering Division

25 SEP 1980
Date

APPROVED BY: SIGNED
Colonel, CE, District Engineer

27 SEP 1980
Date

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

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PHASE I REPORT
NATIONAL DAM SAFETY PROGRAM
ASSESSMENT SUMMARY

Name of Dam	Keller Lake Dam
State Located	Missouri
County Located	Andrew County
Stream	Tributary to Dillon Creek
Date of Inspection	June 2, 1980

Keller Lake Dam was inspected by an interdisciplinary team of engineers ~~from Hoskins-Western-Sonderegger, Inc~~. The purpose of the inspection was to make an assessment of the general conditions of the dam with respect to safety, based upon available data and visual inspection, in order to determine if the dam poses hazards to human life or property.

The guidelines used in the assessment were furnished by the Department of the Army, Office of the Chief of Engineers and developed with the help of several Federal and State agencies, professional engineering organizations, and private engineers.

Keller Lake Dam has a height of twenty-five(25) feet and a storage capa- at the minimum top elevation of the dam of forty-three (43) acre-feet. In accordance with the guidelines, a small size dam has a height greater than or equal to twenty-five (25) feet but less than forty (40) feet and a storage capacity greater than or equal to fifty (50) acre-feet but less than one thousand (1,000) acre-feet. The size classification is determined by either the storage capacity or height, whichever gives the larger size category. Keller ~~Lake~~ Dam is classified as a small size dam.

In accordance with the guidelines and based on visual observation, dam is classified as having a high potential for damage and loss of life. Failure would threaten life and property. The estimated damage zone extends about one mile downstream of the dam. Within the damage zone are two small lakes and dams, eleven trailer homes and Highway I-29.

Our inspection and evaluation indicates that the spillways meet the criteria set forth in the recommended guidelines for a small dam having a high hazard potential. Considering the small volume of water impounded, one-half of the Probable Maximum Flood is the appropriate spillway design flood. The spillways will pass the 100-year flood (1% probability flood, a flood having a one percent chance of being exceeded in any year) without overtopping the dam. The spillways will pass 80% of the Probable Maximum Flood without overtopping the dam. The Probable Maximum Flood (PMF) is defined as the flood that may be expected from the most severe combination of critical meteorologic and hydrologic conditions that are reasonably possible in the region.

No design data were available for this dam. Based on the observation made during the field inspection of the dam. This dam is considered to be structurally and hydrologically adequate and safe.

The following recommendations are made in regard to maintenance of the dam:

a. The willow trees and brush should be removed from the upstream slope.

b. Trees and brush up to 12 to 14 inches in diameter should be removed from the downstream slope under the guidance of an engineer experienced in the design and construction of dams and a good vegetative cover reestablished.

c. A program of regular inspection and maintenance should be initiated with particular emphasis on the removal and/or control of the tree growth on the slopes.

Rey S. Decker
E-3703

Gordon Jamison

Harold Ulmer
Harold Ulmer
E-19246

H. P. Hoskins
Harold P. Hoskins, Chairman of the Board
Hoskins-Western-Sonderegger, Inc.
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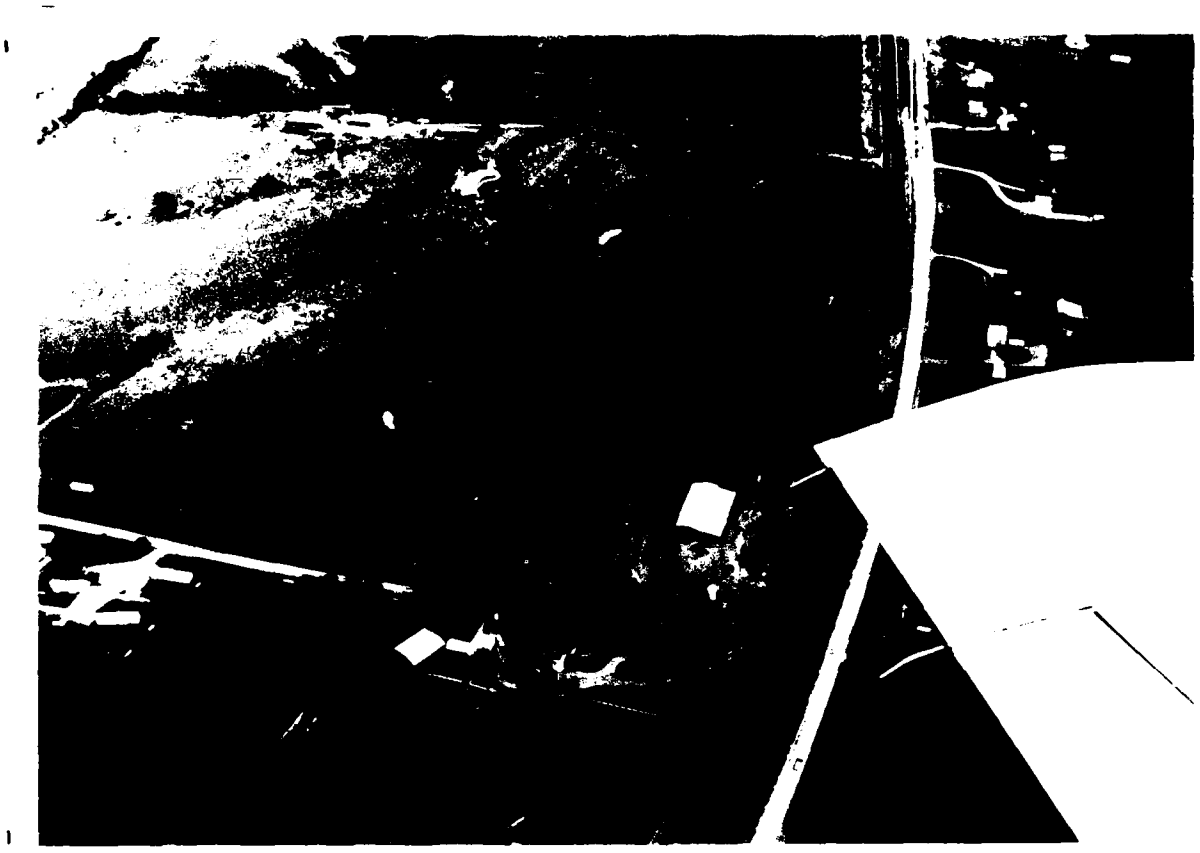


PHOTO NO. 1 - OVERVIEW

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
KELLER LAKE DAM - MO 11608
ANDREW COUNTY, MISSOURI

SECTION 1 - PROJECT INFORMATION

1.1 GENERAL

a. Authority. The National Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army through the Corps of Engineers, to initiate a program of safety inspection of dams throughout the United States. Pursuant to the above, the St. Louis District, Corps of Engineers, District Engineer directed that a safety inspection of Keller Lake Dam be made.

b. Purpose of Inspection. The purpose of the inspection was to make an assessment of the general condition of the dam with respect to safety, based upon available data and visual inspection, in order to determine if the dam poses hazards to human life or property.

c. Evaluation Criteria. Criteria used to evaluate the dam were furnished by the Department of the Army, Office of the Chief of Engineers, in "Recommended Guidelines for Safety Inspection of Dams", Appendix D to "Report of the Chief of Engineers on the National Program of Inspection of Dams," dated May, 1975, and published by the Department of the Army, Office of the Chief of Engineers.

1.2 DESCRIPTION OF PROJECT

a. Description of Dam and Appurtenances.

(1) The dam is an earth fill approximately 425 feet in length and 25 feet in height. The maximum water storage at the minimum top of dam is 43 acre-feet. This site is located in the dissected till plains area of the Central Lowlands Physiographic Region.

(2) The spillway is an uncontrolled earth channel cut through the right abutment. A seven-inch diameter cast iron pipe culvert approximately 23 feet in length crosses under the gravelled road control section spanning the spillway.

(3) Pertinent physical data are given in paragraph 1.3 below.

b. Location. The dam is located in the south central portion of Andrew County, Missouri, as shown on Plate A-2. The dam is shown on Plate A-1 in the SE 1/4 of Section 3, T 58 N, R 35 W.

c. Size Classification. Criteria for determining the size classification of dams and impoundments are presented in the guidelines referenced in paragraph 1.1c above. Keller Lake Dam has a height of 25 feet and a storage capacity at the minimum top elevation of the dam of 43 acre-feet. This dam is classified as a small size dam. A small size dam has a height greater than or equal to 25 feet but less than 40 feet and a storage capacity greater than or equal to 50 acre-feet but less than 1,000 acre-feet. The size classification is determined by either the storage capacity or height, whichever gives the larger size category.

d. Hazard Classification. Guidelines for determining hazard classification are presented in the same guidelines as referenced in paragraph 1.1c above. Based on referenced guidelines and visual observation, this dam is in the High Hazard Classification. The estimated damage zone extends about one mile downstream of the dam. Within the damage zone are two small lakes and dams, eleven trailer homes and Highway I-29.

e. Ownership. The dam is owned by Mr. A. J. Keller, Route 3, St. Joseph, Missouri 64505.

f. Purpose of Dam. The dam was constructed to impound water to be used by a ready-mix concrete plant owned by Mr. A. J. Keller. The concrete plant was sold in 1968, and the reservoir no longer is used for its original purpose.

g. Design and Construction History. The dam was constructed in 1963 by Mr. A. J. Keller who stated that a core trench was excavated six feet into clay. Materials for the embankment were borrowed from the abutments and were compacted with sheepsfoot rollers. A 2 1/2-inch pipeline was constructed through the left end of the dam to carry water from the reservoir to the concrete plant.

h. Normal Operating Procedure. There are no controlled outlets for this dam other than the 2 1/2-inch pipeline formerly used to transport water to the concrete plant. The level of the pool is dependent upon precipitation, infiltration, evaporation, and the capacity of the uncontrolled spillway.

1.3 PERTINENT DATA

a. Drainage Area. 31.3 acres (0.049 acres).

b. Discharge At Damsite.

(1) All discharges at the damsite are through an uncontrolled vegetated earth spillway cut through the right abutment with a gravel covered road normal to the spillway acting as a weir. There is a 7-inch diameter cast iron pipe acting as a culvert under the road that discharges into the spillway channel.

(2) Estimated maximum flood at damsite--- It was reported by Mr. A. J. Keller that the maximum discharge through the spillway produced an approximate depth of 1 foot of water in the spillway. It was not reported when that occurred.

(3) The spillway capacity varies from 0 c.f.s. at its crest (elevation 1018.0 feet) to 327 c.f.s. at the minimum top of dam (elevation 1019.7 feet).

(4) Total spillway capacity at the minimum top of dam is 327 c.f.s. ±

c. Elevations. (Feet above M.S.L.)

(1) Top of dam - 1019.7 (minimum)

(2) Spillway crest - 1018.0 (crest of road);
1017.5 (invert of 7-inch diameter culvert)

(3) Observed pool - 1017.2

(4) Normal pool - 1017.5

(5) Maximum experienced pool - 1018.5 ±

(6) Streambed at centerline - 994.5

(7) Maximum tailwater - Unknown

d. Reservoir. Length (feet) of pool

(1) Spillway Crest - 600 ±

(2) Top of Dam (minimum) - 700±

e. Storage (Acre-feet).

(1) Top of dam - 43 ±

(2) Spillway crest - 34 ±

(3) Observed pool - 34 ±

(4) Normal pool - 34 ±

(5) Maximum experienced pool - 35 ±

f. Reservoir Surface (Acres).

(1) Top of dam - 6 ±

(2) Spillway crest - 4 ±

(3) Observed pool - 4 ±

(4) Normal pool - 4 ±

(5) Maximum experienced pool - 5 ±

g. Dam.

(1) Type - Earth fill

(2) Length - 425 ft. ±

(3) Height - 25 ft. ±

(4) Top width - 15 ft. ±

(5) Side slopes.

(a) Downstream - 1V on 2.1 H, 1V on 3.3 H, 1V on 1.6 H (avg. 1V on 2 H)

(b) Upstream - 1V on 1.3 H (exposed)

(6) Zoning - unknown

(7) Impervious core - Core trench excavated 6 feet into clay (reported by Mr. A. J. Keller).

(8) Cutoff - unknown

(9) Grout curtain - unknown

(10) Wave protection - concrete rubble riprap

(11) Drains - none

h. Diversion Channel and Regulating Tunnel. None

i. Spillway.

(1) Principal (and only)

(a) Type - Vegetated earth, uncontrolled spillway cut through right abutment with a 7-inch diameter cast iron pipe culvert under the gravel surfaced road that crosses the spillway.

(b) Control section - gravel surfaced road crossing the spillway acting as a weir.

(c) Crest elevation - 1018.0 (minimum road surface elevation)

(d) Upstream Channel - clear of vegetation. Water surface at the upstream end of the 7-inch culvert. Slope of channel unknown.

(e) Downstream Channel - Channel excavated in a hillside in a westerly direction from the right end of the dam approximately 500 feet where it discharges into a small reservoir.

j. Regulating Outlets. None

SECTION 2 - ENGINEERING DATA

2.1 DESIGN

No design data were available for this dam.

2.2 CONSTRUCTION

No construction data were available. Mr. A. J. Keller reported that he had constructed the dam in 1963 and that a core trench had been excavated to a depth of six feet into clay. It was also reported that the embankment materials were borrowed from the abutments and that compaction was done with sheepsfoot rollers.

2.3 OPERATION

No data were available on spillway operation. It was reported by Mr. A. J. Keller that the maximum discharge in the spillway produced an approximate depth of one foot of water in the spillway.

2.4 EVALUATION

a. Availability. No data were available

b. Adequacy. The field surveys and visual observations presented herein are considered adequate to support the conclusions of this report. Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" were not available, which is considered a deficiency. These seepage and stability analyses should be performed for appropriate loading conditions (including earthquake loads) and made a matter of record.

c. Validity. Not applicable.

SECTION 3 - VISUAL INSPECTION

3.1 FINDINGS

a. General. A visual inspection of the Keller Lake Dam was made on June 2, 1980. Engineers from Hoskins-Western-Sonderegger, Inc., Lincoln, Nebraska making the inspection were: R. S. Decker, Geotechnical, Garold Ulmer and Gordon Jamison, Hydrology and Hydraulics. The owner, Mr. A. J. Keller, was interviewed prior to the inspection but was not present during the inspection.

b. Dam.

(1) Geology and Soils (abutment and embankment). Keller Lake Dam is located in the dissected till plains area within the Central Lowlands Physiographic Region. The dam site is in a region where the stratigraphic sequence consists of loess, 4 to 8 feet thick, overlying Kansan-age glacial drift, of undetermined thickness and character which in turn overlies bedrock. Bedrock beneath the site consists of strata assigned to the Pedee and Lansing Groups, Missourian Series, Pennsylvanian System. Strata of these two groups are comprised of interlayered sequences of shale, sandstone, and limestone.

The upland soils in the dam area consists of soils of the Knox-Marshall soil association. This soil association is common in the dissected areas adjacent to the Missouri River where soils are formed on deep loess deposits. They are positioned on rolling to hilly topography with the Knox soils occupying the steeper slopes and narrow ridgetops. The Marshall soil occupies the more gently sloping areas. Both soils have a moderate infiltration rate.

The abutments consist of loess colluvium overlying glacial till. Till (gravelly CH) is exposed along the shoreline on the right side of the reservoir (See Photo No. 10) Materials in the valley consist of alluvium of unknown depth. Materials in the dam are CL-CH borrowed from the loess-till abutments.

(2) Upstream Slope. The upstream slope is pretty well covered with concrete rubble riprap. No erosion was noted. A few small trees and brush are growing along the waterline. No bulges or slumps were observed. Some loose dirt had been recently placed along the upstream face in the area of station 2 + 70 to 3 + 00. The reason for this new fill is not known. Photo No. 2 shows the upstream slope and Photo No. 5 the recent repair work on the slope.

(3) Crest. The crest is well vegetated with adapted grasses and legumes. Measurements indicate that the crest elevation is quite uniform. A section of the upstream crest (and upstream slope) between centerline station 2 + 70 and 3 + 00 had been recently filled with soil as shown in Photo No. 5. No cracks

were observed on the crest. No bulges were observable along the crest, but two utility poles on the crest lean downstream at about 5 to 10 degrees off vertical. The crest and leaning poles are shown in Photo 3, 4 and 5.

(4) Downstream Slope. The downstream slope is well covered with brush and trees up to 12 to 14 inches in diameter. There is a sparse cover of grass beneath the trees. No significant erosion was noted. The downstream slope is shown in Photos 3, 4 & 7. A berm-like projecting or slump occurs on the downstream slope about 10 feet vertically below the crest, from about centerline station 1 + 75 to 3 + 50. It is not known whether this was a constructed berm or is the result of bulging and/or spreading of the embankment. Although the power poles on the crest are leaning downstream, the trees on the downslope in this area do not appear to be misaligned At the present time it appears to be stable and is used as a cow path. This area is shown in Photo No. 6.

A small seepage area was observed in the lower end of the right abutment trough. There was no visible discharge from this seep.

c. Appurtenant Structures.

(1) Spillway- The uncontrolled spillway consists of a cut through the right abutment. It has a bottom width of 35 feet ± with side slopes of 1V on 12 H or flatter. A roadway, that appeared relatively new, was constructed across the spillway. A 7-inch cast iron pipe passed through the base of the roadway. An old conservation terrace serves as the outlet for the spillway. This terrace goes around the ridge into an adjacent drainage way. The first 80 to 100 feet of outlet channel immediately downstream from the roadway has been recently denuded of vegetation. The terrace channel downstream from this area is well vegetated with adapted grasses. The entrance section is open and clear. Photos 8 & 9 show the spillway.

(2) Drawndown Facility- Mr. A. J. Keller reported that there is a 2 1/2-inch steel pipeline passing through the left end of the dam that was used as a water supply for the concrete ready-mix plant. The concrete plant is now dismantled, and this pipeline has not been used for several years.

d. Reservoir Area. The area around the reservoir is well grassed, and there was no erosion apparent along the waterline. Mr. A. J. Keller reported that a permanent spring along the west side feeds into the reservoir. Photo No. 11 shows a portion of the reservoir.

e. Downstream Channel. The downstream channel from the spillway does

not enter the old channel downstream from the dam. The channel is excavated in a hillside leading to the west approximately 500 feet where it discharges into a small reservoir. Photo No. 1 shows a portion of the small reservoir at the extreme left center. The channel is devoid of vegetative growth for a distance of 80 to 100 feet downstream from the gravelled road that serves as the spillway control section, and the raw appearance would indicate recent construction. The remainder of the channel has good vegetative growth with no trees or brush. Photos 8 and 9 show views of the channel immediately downstream from the control section.

3.2 EVALUATION

This dam is in reasonably good shape with no serious potential of failure. The slight seepage in the right abutment trough has no apparent detrimental effect upon the integrity of the dam. The cause of the irregularities (berm, slump or what) in the downstream slope and the leaning power poles is not known; however, there is no evidence of recent deformation on the slope (trees on the slope, up to 12 inches in diameter, appear to be near vertical). Tree growth on the downstream slope could ultimately impair the integrity of the dam.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 PROCEDURES

The only controlled outlet for this dam is the 2 1/2-inch pipe that formerly carried water from the reservoir to the concrete plant. The pool level is controlled by rainfall, infiltration, evaporation, and the capacity of the uncontrolled spillway.

4.2 MAINTENANCE OF DAM

The extensive tree growth on the downstream slope of the dam would indicate some deficiency in maintenance operations.

4.3 MAINTENANCE OF OPERATING FACILITIES

No operating facilities exist at this dam other than the 2 1/2-inch pipe that formerly carried water from the reservoir to the concrete plant. The concrete plant is no longer in use.

4.4 DESCRIPTION OF ANY WARNING SYSTEM IN EFFECT

There is no warning system in effect for this dam.

4.5 EVALUATION

The majority of deficiencies observed during the inspection were due to a lack of routine maintenance.

SECTION 5 - HYDRAULIC/HYDROLOGIC

5.1 EVALUATION OF FEATURES

a. Design Data. No design data were found for this dam.

b. Experience Data. The drainage area, reservoir surface area, and elevation-storage data were developed from the USGS St. Joseph North, Missouri, 7.5 minute topographic quadrangle map. The hydraulic computations for the spillway and dam overtopping discharge ratings were based on data collected in the field at the time of the field inspection.

c. Visual Observations.

(1) The spillway is cut through the right abutment and discharges into a terrace which drains into an adjoining small reservoir (See Photo No. 1). Spillway releases will not endanger the integrity of the dam.

(2) A road over the spillway with a 7-inch pipe culvert appeared to have been recently constructed.

(3) It is reported by Mr. A. J. Keller that there is a 2 1/2-inch drawdown pipe through the dam which had been used as a water supply for a concrete plant in the past. The pipe was not located during the inspection.

d. Overtopping Potential. The spillways are too small to pass the probable maximum flood without overtopping. The spillways will pass the 1% probabilistic flood as well as 80% of the probable maximum flood without overtopping the dam. The overtopping which the embankment would experience during the PMF is such that it should not cause excessive damage. The results of the routings through the dam are tabulated in regards to the following conditions:

Frequency	Inflow Discharge c.f.s.	Outflow Discharge c.f.s.	Maximum Pool Elevation	*Maximum Depth Over Dam, Ft.	Duration Over Top Hr.
1/2 PMF	270	190	1019.3	0	0
PMF	550	430	1019.9	0.2	1-
0.80 PMF	440	320	1019.7	0	0

*Minimum top of dam elevation - 1019.7

According to the recommended guidelines from the Department of the Army, Office of the Chief of Engineers, this dam is classified as having a high hazard rating and a small size. Therefore, the 1/2 PMF to the PMF is the test for the adequacy of the dam and its spillway.

The estimated damage zone is described in Paragraph 1.2d in this report.

SECTION 6 - STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

a. Visual Observation. This dam appears to be structurally stable from the standpoint of strength and excess seepage pressures. Any deformation processes that could have caused the irregularities in the downstream slope have evidently stabilized. The dam has been in place with full reservoir for 17 years, and there is no evidence of recent movements of slides on the downstream slope. Uncontrolled tree growth on the downstream slope might ultimately affect the safety of the structure.

b. Design and Construction Data. No design or construction data were available. Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" were not available, which is considered a deficiency.

c. Operating Records. There are no controlled operating facilities for this dam other than the 2 1/2-inch water line which formerly carried water from the reservoir to the concrete plant.

d. Post Construction Changes. It would appear that the road crossing the spillway has been constructed rather recently.

e. Seismic Stability. This dam is located in Seismic Zone 1. An earthquake of magnitude predicted in this area is not expected to cause structural failure of this dam.

SECTION 7- ASSESSMENT/REMEDIAL MEASURES

7.1 DAM ASSESSMENT

a. Safety. This dam is in reasonably good condition except for extensive tree growth on the downstream slope and a few small willows on the upstream slope. It is considered to be structurally stable. It is hydrologically adequate to pass 80% of the probable maximum flood (PMF) without overtopping and the PMF storm will only overtop the dam by 0.2 foot ± for about 1 hour which should not cause extensive damage to the embankment.

This dam does not appear to have any serious potential of failure. Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" were not available which is considered a deficiency.

b. Adequacy of Information. Due to the lack of engineering data, the conclusions in this report are based upon performance history and visual observations. Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" were not available which is considered a deficiency.

c. Urgency. There does not appear to be any urgency to accomplish the remedial measures recommended in paragraph 7.2.

d. Necessity for Further Investigations. Further investigations are not considered necessary.

e. Seismic Stability. This dam is located in Seismic Zone 1. An earthquake of this magnitude is not expected to be hazardous to this dam.

7.2 REMEDIAL MEASURES

a. Alternatives.

(1) Since the dam and spillway pass 80 percent of the PMF and are in relatively good condition, no alternative methods of accomodating the PMF are required.

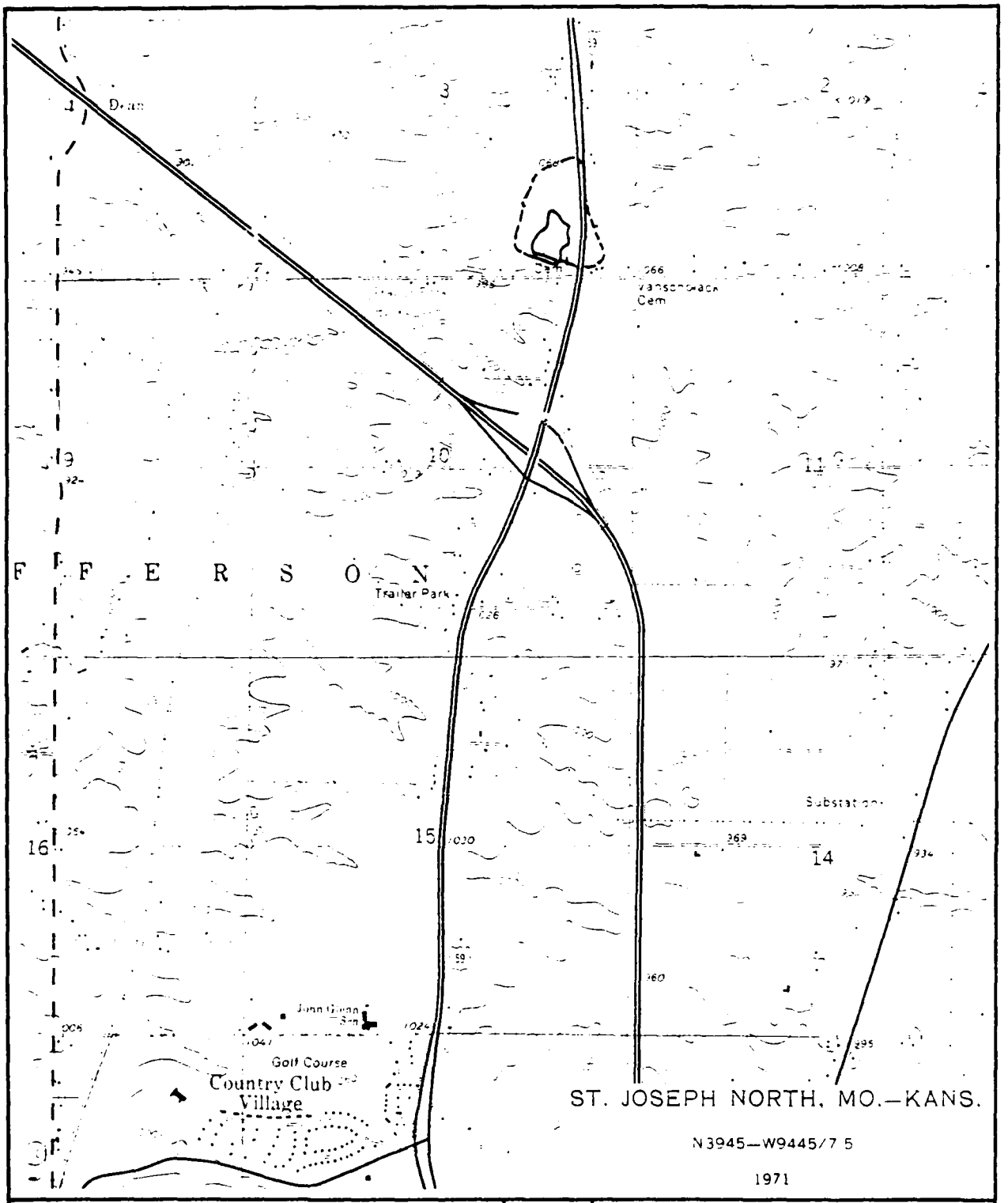
b. Operation and Maintenance Procedures.

(1) The willow trees and brush should be removed from the upstream slope.

(2) Trees and brush up to 12 to 14 inches in diameter should be removed from the downstream slope under the guidance of an engineer experienced in the design and construction of dams. A good vegetative cover should be reestablished.

(3) A program of regular inspection and maintenance should be initiated with particular emphasis on the removal and/or control of tree growth on the slopes.

APPENDIX A
MAPS



Scale in feet

2000 1000 0 2000 4000

Contour Interval – 20'

N

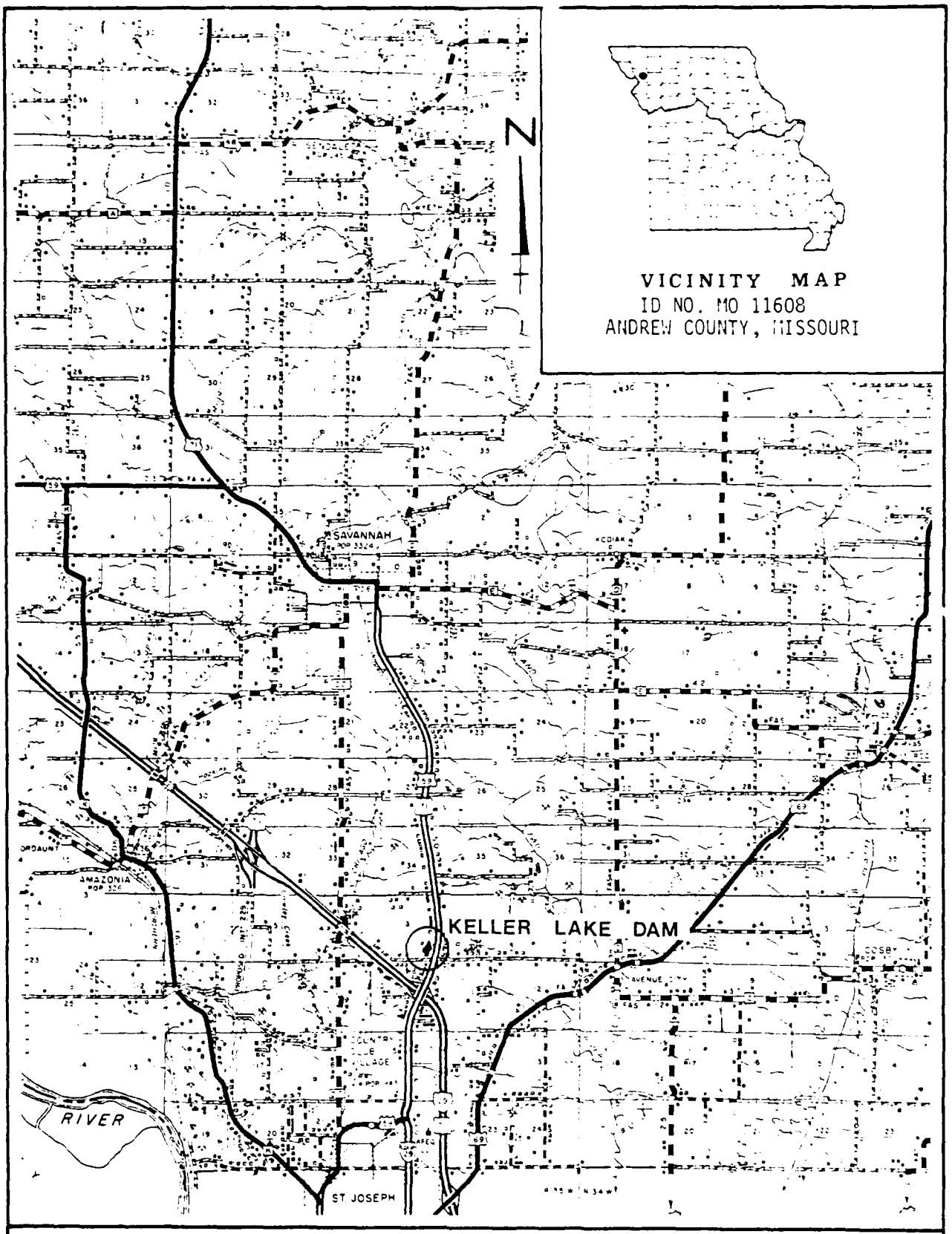
VICINITY TOPOGRAPHY

KELLER LAKE DAM

ANDREW COUNTY, MISSOURI

MO. 11608

PLATE A-1



VICINITY MAP
ID NO. MO 11608
ANDREW COUNTY, MISSOURI

Scale in miles
0 1 2 3 4 5

LOCATION MAP

PLATE A-2

APPENDIX B
PHOTOGRAPHS

KELLER LAKE DAM
ANDREW COUNTY, MISSOURI
MO 11608

PHOTO INDEX

PLATE B-1

PHOTO NO. 2 - UPSTREAM FACE TAKEN FROM LEFT END. WELL COVERED WITH OLD CONCRETE RUBBLE

PHOTO NO. 3 - CREST TAKEN FROM LEFT END

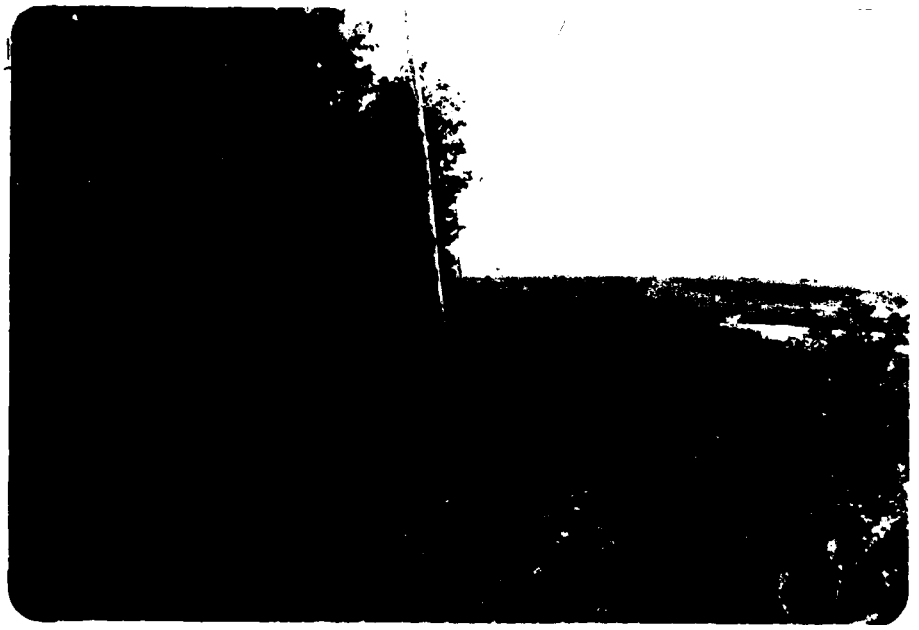


PHOTO NO. 4 - LOOKING LEFT TO RIGHT ALONG THE DOWNSTREAM CREST AT TWO POWER POLES WHICH ARE OFF VERTICAL ABOUT 5^{o} to 10^{o}

PHOTO NO. 5 - REPAIR WORK ON UPSTREAM FACE AT ABOUT STA. 2+70 to 3+00

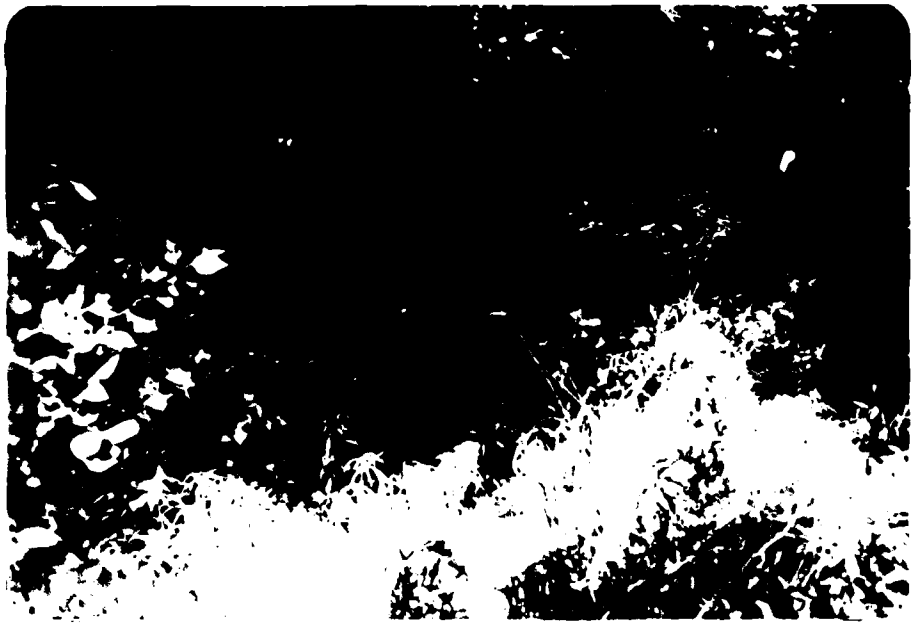


PHOTO NO. 6 - LOOKING DOWNSTREAM ON THE BACKSLOPE SHOWING THE COW PATH

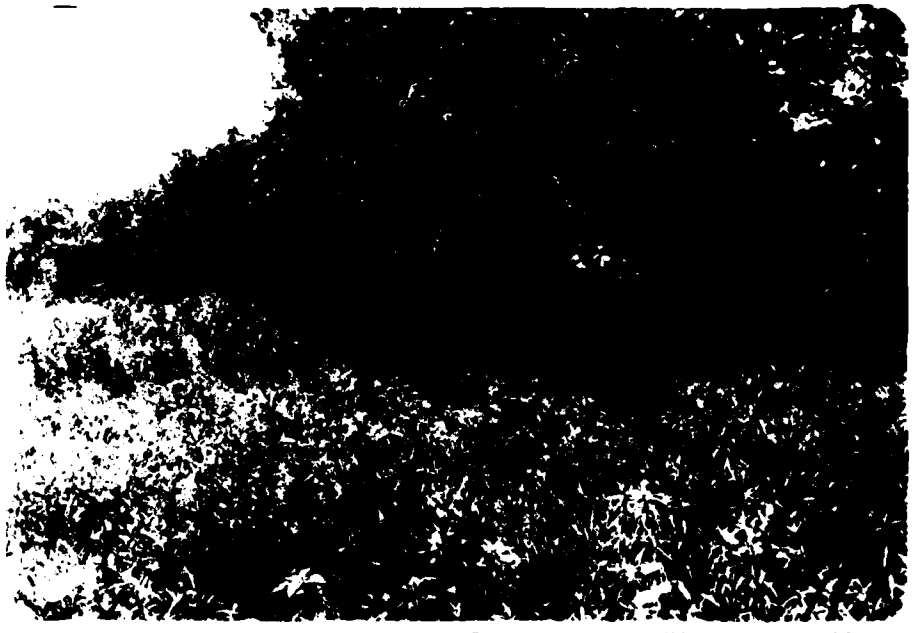


PHOTO NO. 7 - DOWNSTREAM SLOPE TAKEN FROM LEFT END. SLOPE ALMOST COMPLETELY COVERED WITH TREES & RUBBISH. TREES UP TO 12 TO 15 INCHES IN DIAMETER

PHOTO NO. 8 - LOOKING UPSTREAM IN THE EMERGENCY SPILLWAY

PHOTO NO. 9 - LOOKING DOWNSTREAM THE EMERGENCY SPILLWAY WHICH DRAINS INTO A LOW TERRACE & INTO AN ADJOINING SMALL RESERVOIR

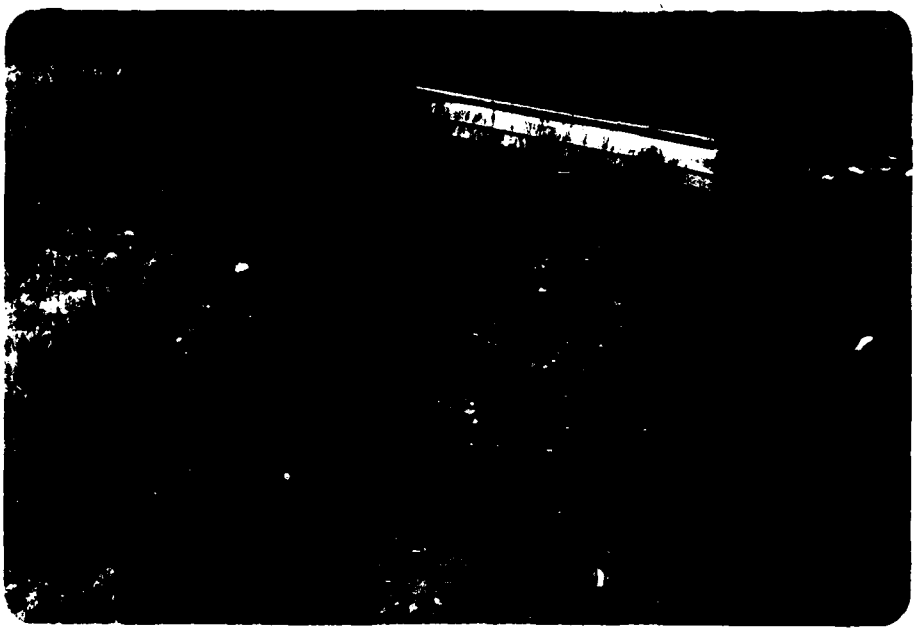


PHOTO NO. 10 - GLACIAL TILL OUTCROPPING ALONG RIGHT SHORELINE JUST UPSTREAM FROM THE RIGHT END OF DAM

PHOTO NO. 11 - LOOKING UPSTREAM AT ABOUT STA. 4+30

PHOTO NO. 12 - LOOKING DOWNSTREAM FROM ABOUT STA. 4+30. NOTE THE OTHER SMALL LAKE JUST DOWNSTREAM OF KELLER LAKE

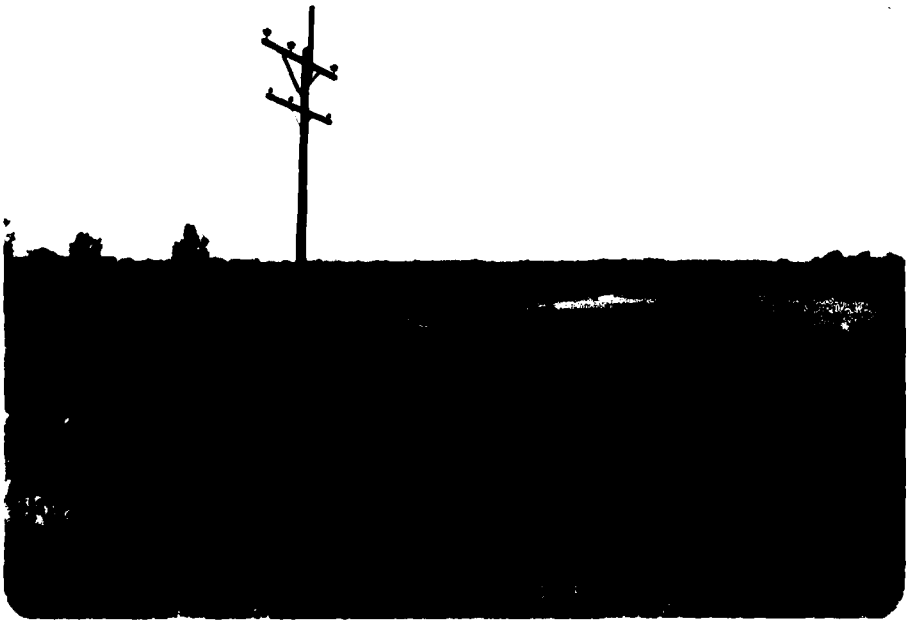


PHOTO NO. 13 - OVERVIEW FROM LEFT SIDE

PHOTO NO. 14 - OVERVIEW FROM NORTH END

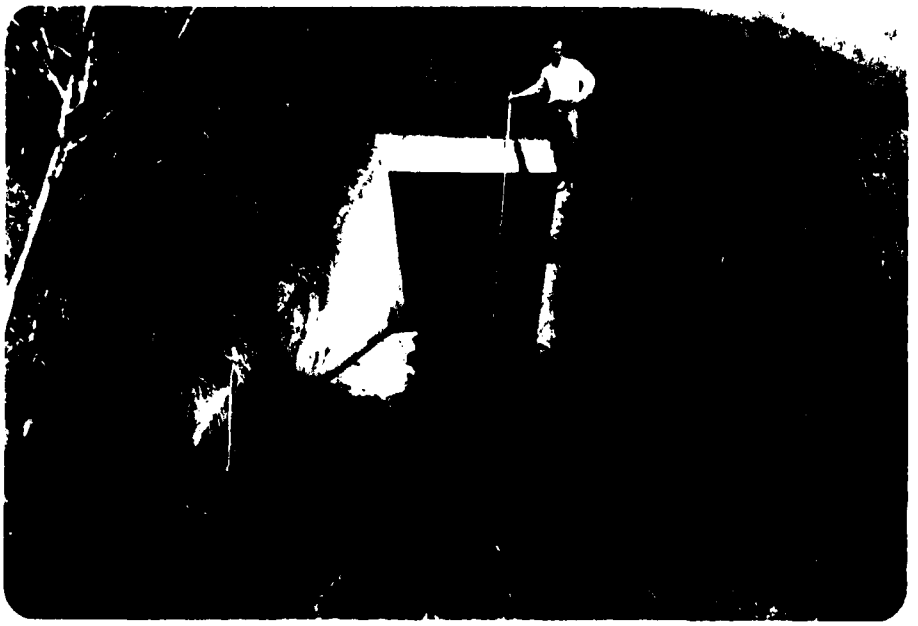
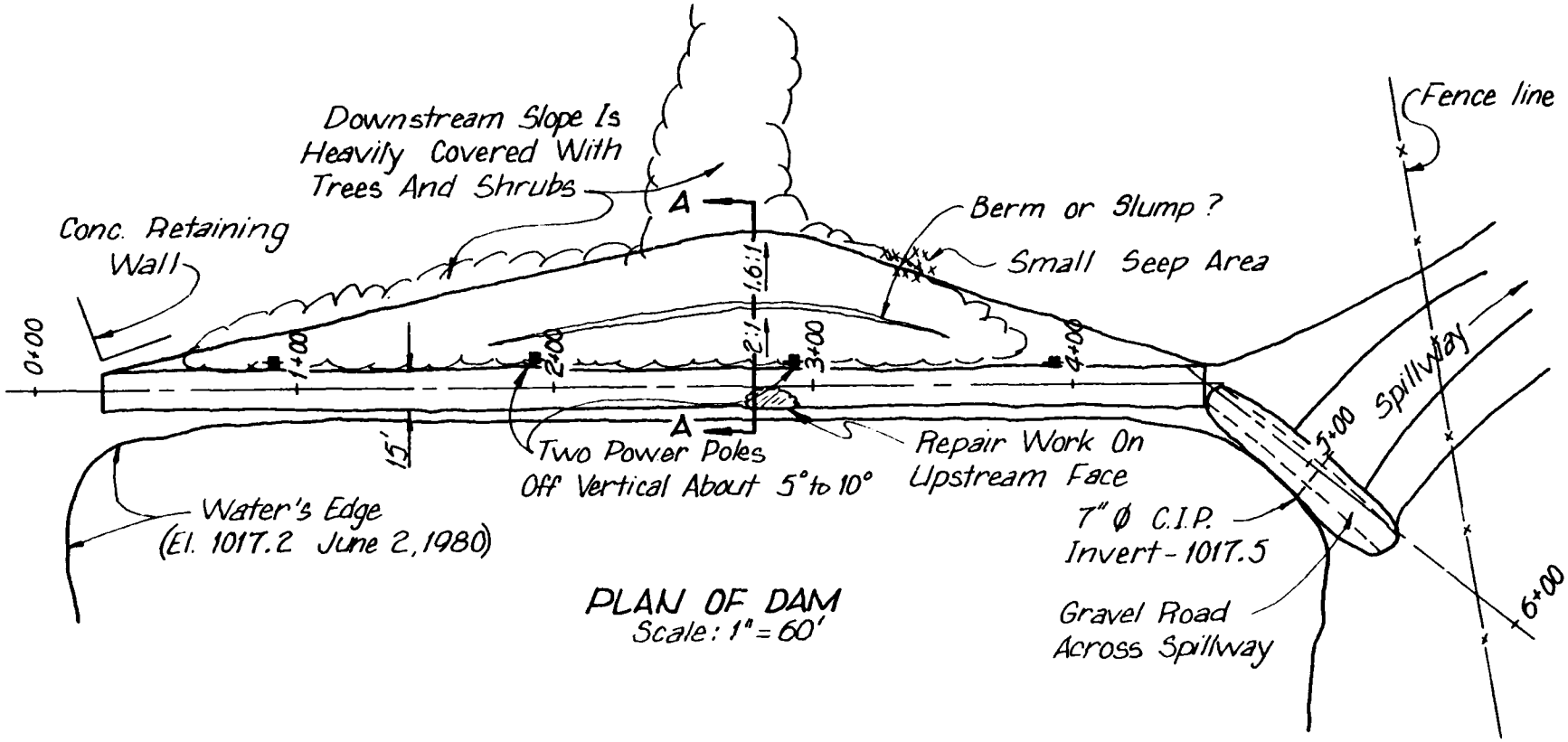
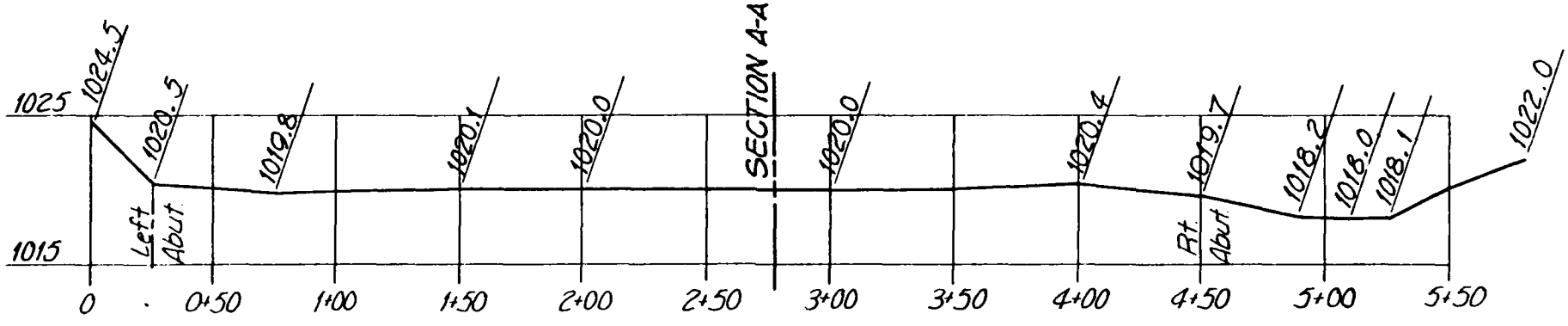


PHOTO NO. 15 - 6' x 6' CULVERT UNDER INTERSTATE 29

APPENDIX C
PROJECT PLATES

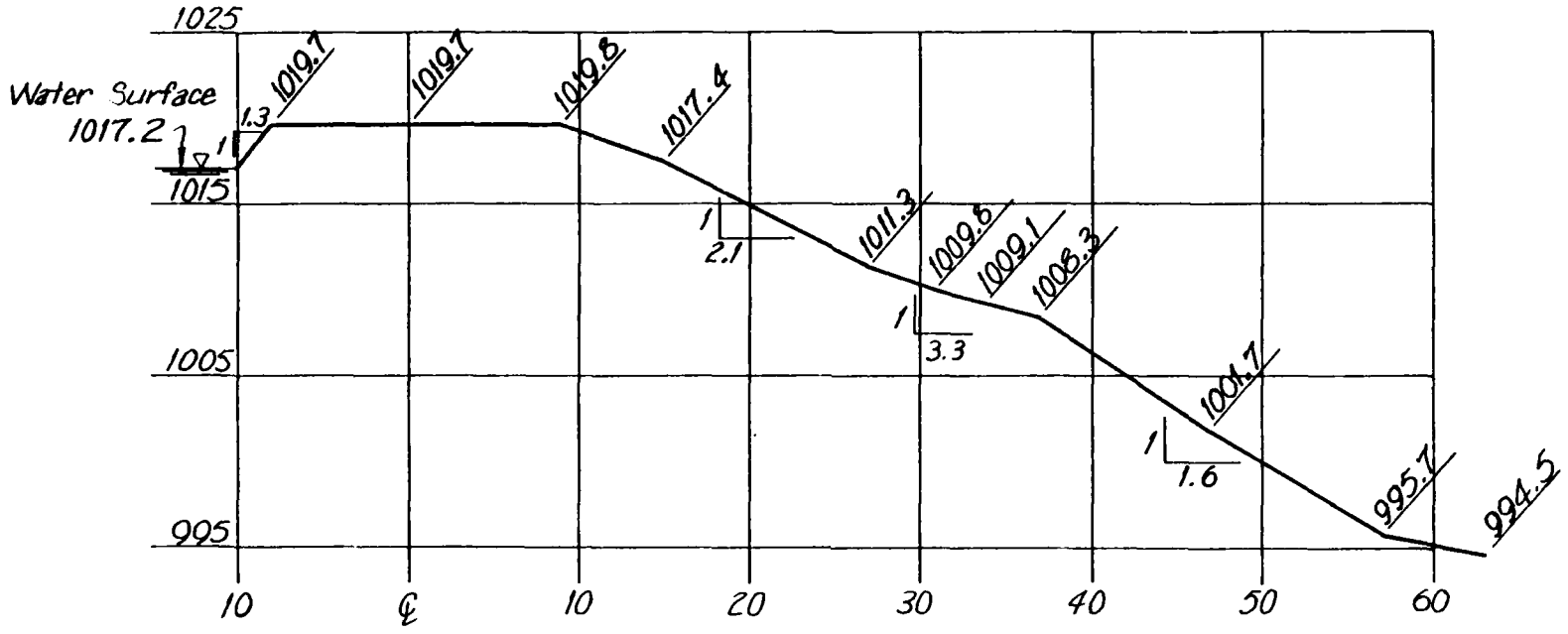


PLAN OF DAM
Scale: 1" = 60'



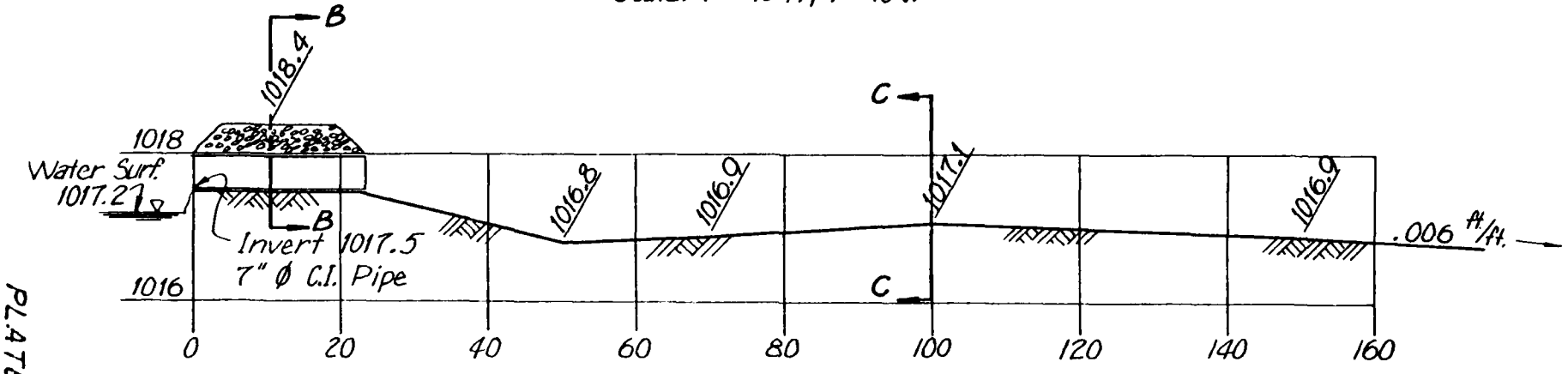
PROFILE ALONG CENTERLINE OF DAM
Scale: 1" = 60' H; 1" = 10' V.

PLATE C-1



MAXIMUM SECTION OF DAM AT STATION 2+78 (SECTION A-A)

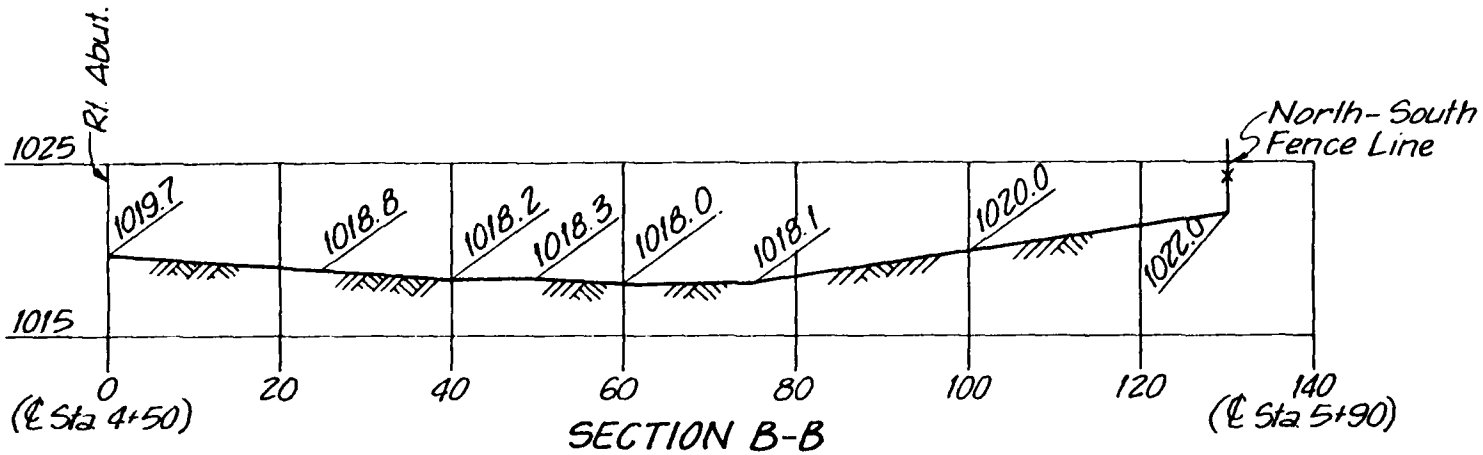
Scale: 1" = 10'H; 1" = 10V.



PROFILE ALONG CENTERLINE OF SPILLWAY

Scale: 1" = 20'H; 1" = 2'V.

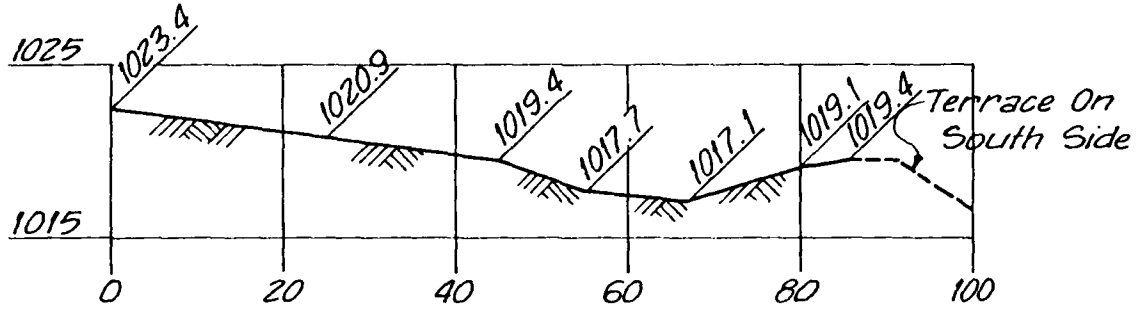
PLATE C-2



SECTION B-B

SECTION OF SPILLWAY ALONG CENTERLINE OF DAM

Scale: 1" = 20'H; 1" = 10'V.



SECTION C-C

SECTION OF SPILLWAY APPROX. 100' DOWNSTREAM

Scale: 1" = 20'H; 1" = 10'V.

PLATE C-3

APPENDIX D
HYDRAULIC AND HYDROLOGIC DATA

HYDROLOGIC COMPUTATIONS

1. The SCS dimensionless unit hydrograph and the systemized computer program HEC-1 (Dam Safety Version), July 1978, prepared by the Hydrologic Engineering Center, U.S. Corps of Engineers, Davis, California, were used to develop the inflow hydrographs (See this Appendix).

   a. Twenty-four hour, one percent probabilistic rainfall for the dam location was taken from the data for the rainfall station at Sweet Springs, Mo. as supplied by the St. Louis District, Corps of Engineers per their letter dated 4 March 1980. The twenty-four probable maximum precipitation was taken from the curves of Hydrometeorological Report No. 33 and current Corps of Engineers and St. Louis policy and guidance for hydraulics and hydrology. The rainfall distribution as described by EM 1110-2-1411 (Standard Project Storm) was used in distributing the rainfall.

   b. Drainage area = 0.049 square miles (31.3 acres).

   c. Time of concentration of runoff = 9.6 minutes (computed from SCS "Upland" method). 900 feet of the watershed is in short grass pasture (overland flow) with an average watershed slope of approximately 6%. The overland flow velocity was assumed to be 1.7 ft/sec. Approximately 575 ft of the watershed course was reservoir. Assuming a mean depth of 10 feet, the velocity through the reservoir was assumed to be 16 ft/sec. Travel time was computed using the equation: T_t = 1/3600V, where 1 = length, in feet and V = velocity.

      The time of concentration was verified using the "Kirpich" method. A value of 7.7 minutes was obtained. The SCS "Upland" method value was used due to the large amount of overland flow in lieu of small gully flow.

   d. The antecedent storm conditions for the probable maximum precipitation were heavy rainfall and low temperatures which occurred on the previous 5 days (SCS AMC III). The antecedent storm conditions for the one percent probabilistic precipitation were an average of the conditions which have preceded the occurrence of the maximum annual flood on numerous watersheds (SCS AMC II). The initial pool elevation was assumed at the crest of the spillway. The 7-inch diameter spillway pipe was assumed negligible in relation to the routings due to the antecedent storm preceding the routings.

   e. The total twenty-four hour storm duration losses for the one percent probabilistic storm were 3.35 inches. The total losses for the PMF storm were 1.87 inches. These data are based on SCS runoff curve No. 86 and No. 71 for antecedent moisture conditions SCS AMC III and AMC II respectively. The watershed is composed of primarily the SCS soil association Marshall-Knox of which both are of hydrologic soil group B. The watershed is mostly in pasture.

   f. Average soil loss rates = 0.08 inch per hour approximately

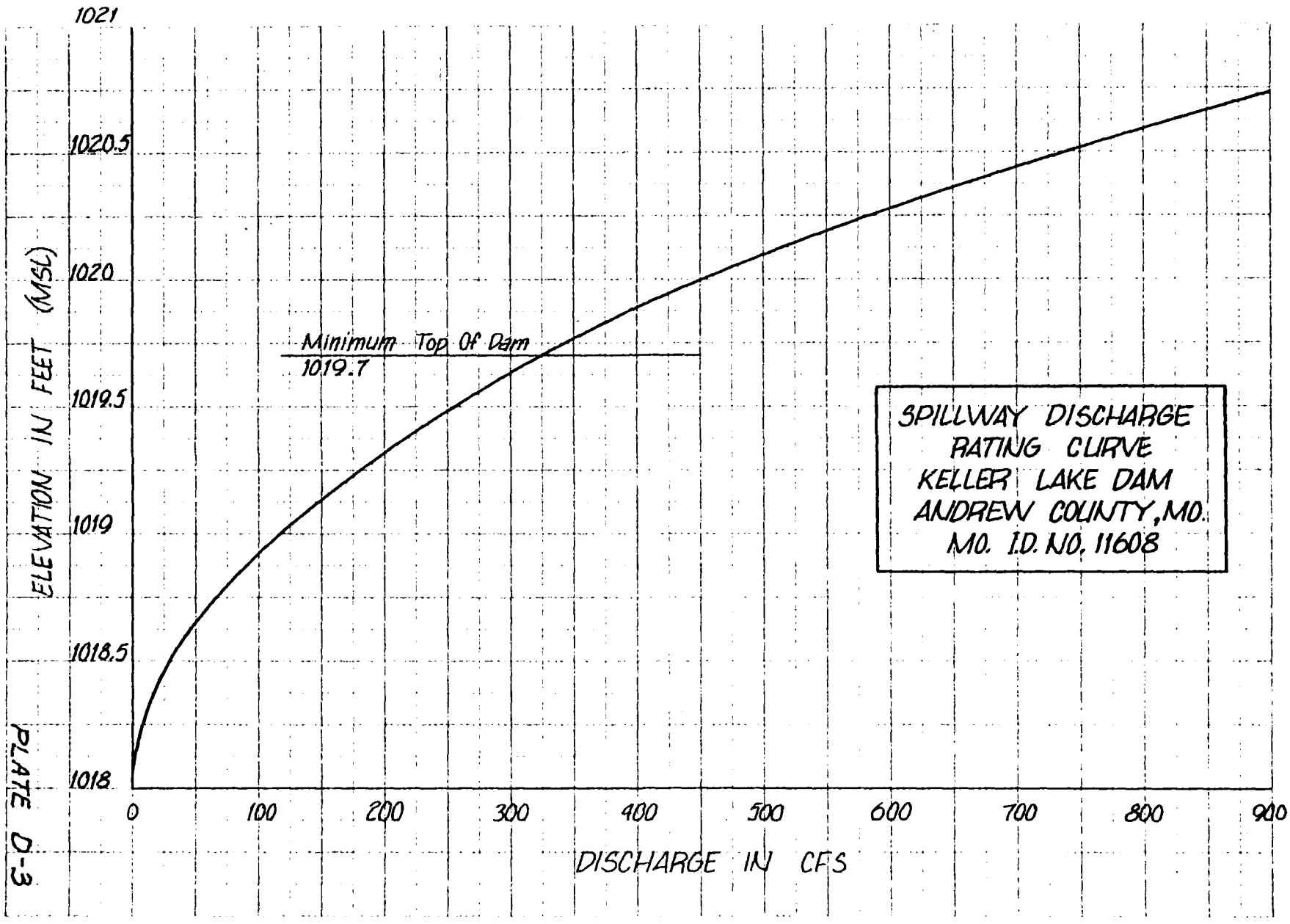
g. The owner stated that the reservoir was spring fed. The spring keeps the lake level about constant; therefore, it replenishes only what the lake loses due to evaporation. With such a small surface area (4-6 acres), evaporation would be minimal. For this reason, the flow into the reservoir from the spring was ignored in the hydrologic routings of the dam.

2. The combined discharge rating consisted of two components: the flow through the spillway and the flow over the top of the dam.

   a. The spillway discharge rating was developed using methods for flow over Highway Embankments in U.S.G.S. TWRI, BK. 3, Ch. A-5 (coefficients based on h/l ratios and a gravel road surface).

   b. The flows over the dam crest were developed using the HEC-1 (Dam Safety Version) program using the irregular top of dam option.

3. Floods were routed through the reservoir using the HEC-1 (Dam Safety Version) program to determine the capabilities of the spillway and dam embankment crest. The input, output, and plotted hydrographs are attached in this Appendix.


1021
1020.5
1020
1019.5
1019
1018.5
1018
ELEVATION IN FEET (MSL)
Minimum Top Of Dam
1019.7
0
100
200
300
400
500
600
700
800
900
DISCHARGE IN CFS
SPILLWAY DISCHARGE
RATING CURVE
KELLER LAKE DAM
ANDREW COUNTY, MO.
MO. I.D. NO. 11608
PLATE D-3

LISTING OF CARD INPUT DATA

```
A1       ANALYSIS OF DAM OVERTOPPING USING RATIOS OF PMF
A2       HYDROLOGIC-HYDRAULIC ANALYSIS OF SAFETY OF KELLER LAKE DAM 11608
A3       RATIOS OF PMF ROUTED THROUGH THE RESERVOIR
D 0002880000000000000005                              000000000000000000000003
B1000005
J 000001000000900000001
J1000.5000000.6000000.7000000.7500000.8CC0000.8500000.9C00000.9500001.00
K 00000000000001                      00CCC00CC000000000000001
K1       CALCULATION OF INFLOW HYDROGRAPH TO RESERVOIR 11608
M 000001000000020000.049              0000.049000001.0                    0000C001
P 000000000024.1000001020000012100000130
T                                                        -1.0    -86.0
W2000000000000.17
X 000000     -.0100000001
K 00000100000002                      00CCC00200000000000000001
K1       ROUTED FLOWS THRU RESERVOIR 11608
Y                           000000010CCC0001
Y1000001                                              -1018.0      -1
Y41018.0001018.5001019.1001019.7001020.5001021.0001022.0001023.0001024.0001025.0
Y5000000000028.9000140.3000327.4000737.8000010840000191200002988000042270000 5606
$A00000000004.25000006.0000014.7
$E0995.0001017.5001020.0001040.0
$$1018.0
$D1019.7000002.9000001.50000425.
$L000000000000520000019500000360000042000000425000004250000042 5
$V1019.7001019.9001020.0001020.2001020.4C01020.6001021.0001025.0
K 000099
A
A
A
A
A
```

PLATE D-4

```
**********************************
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  26 FEB 79
**********************************

RUN  DATE= 80/07/16.
     TIME= 14.45.24.
```

ANALYSIS OF DAM OVERTOPPING USING RATIOS OF PMF
HYDROLOGIC-HYDRAULIC ANALYSIS OF SAFETY OF KELLER LAKE DAM 11608
RATIOS OF PMF ROUTED THROUGH THE RESERVOIR

JOB SPECIFICATION

NQ	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
288	0	5	0	0	0	0	0	3	0

JOPER	NWT	LROPT	TRACE
5	0	0	0

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 NRTIO= 9 LRTIO= 1

RTIOS= .50 .60 .70 .75 .80 .85 .90 .95 1.00

********** ********** ********** ********** **********

SUB-AREA RUNOFF COMPUTATION

CALCULATION OF INFLOW HYDROGRAPH TO RESERVOIR 11608

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
CCCOD1	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	2	.05	0.00	.05	1.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	24.10	102.00	121.00	130.00	0.00	0.00	0.00

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	-1.00	-86.00	0.00	0.00

CURVE NO = -86.00 WETNESS = -1.00 EFFECT CN = 86.00

UNIT HYDROGRAPH DATA
TC= 0.00 LAG= .17

RECESSION DATA
STRTQ= 0.00 QRCSN= -.01 RTIOR= 1.00

UNIT HYDROGRAPH 12 END OF PERIOD ORDINATES, TC= 0.00 HOURS, LAG= .17 VOL= 1.00

34.	103.	106.	66.	33.	18.	9.	5.	3.	1.
1.	0.								

END-OF-PERIOD FLOW

PLATE D-5

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
1.01	.05	1	.01	0.00	.01	0.	1.01	12.05	145	.20	.19	.01	27.
1.01	.10	2	.01	0.00	.01	0.	1.01	12.10	146	.20	.19	.01	41.
1.01	.15	3	.01	0.00	.01	0.	1.01	12.15	147	.20	.19	.01	55.
1.01	.20	4	.01	0.00	.01	0.	1.01	12.20	148	.20	.20	.01	64.
1.01	.25	5	.01	0.00	.01	0.	1.01	12.25	149	.20	.20	.01	69.
1.01	.30	6	.01	0.00	.01	0.	1.01	12.30	150	.20	.20	.01	71.
1.01	.35	7	.01	0.00	.01	0.	1.01	12.35	151	.20	.20	.01	73.
1.01	.40	8	.01	0.00	.01	0.	1.01	12.40	152	.20	.20	.01	74.
1.01	.45	9	.01	0.00	.01	0.	1.01	12.45	153	.20	.20	.01	74.
1.01	.50	10	.01	0.00	.01	0.	1.01	12.50	154	.20	.20	.01	74.
1.01	.55	11	.01	0.00	.01	0.	1.01	12.55	155	.20	.20	.01	75.
1.01	1.00	12	.01	0.00	.01	0.	1.01	13.00	156	.20	.20	.01	75.
1.01	1.05	13	.01	0.00	.01	0.	1.01	13.05	157	.25	.24	.01	76.
1.01	1.10	14	.01	0.00	.01	0.	1.01	13.10	158	.25	.24	.01	81.
1.01	1.15	15	.01	0.00	.01	0.	1.01	13.15	159	.25	.24	.01	85.
1.01	1.20	16	.01	0.00	.01	0.	1.01	13.20	160	.25	.24	.01	88.
1.01	1.25	17	.01	0.00	.01	0.	1.01	13.25	161	.25	.24	.01	89.
1.01	1.30	18	.01	0.00	.01	0.	1.01	13.30	162	.25	.24	.01	90.
1.01	1.35	19	.01	0.00	.01	0.	1.01	13.35	163	.25	.24	.01	90.
1.01	1.40	20	.01	0.00	.01	0.	1.01	13.40	164	.25	.24	.01	91.
1.01	1.45	21	.01	0.00	.01	0.	1.01	13.45	165	.25	.24	.01	91.
1.01	1.50	22	.01	0.00	.01	0.	1.01	13.50	166	.25	.24	.00	91.
1.01	1.55	23	.01	0.00	.01	0.	1.01	13.55	167	.25	.24	.00	91.
1.01	2.00	24	.01	0.00	.01	0.	1.01	14.00	168	.25	.24	.00	91.
1.01	2.05	25	.01	0.00	.01	0.	1.01	14.05	169	.31	.30	.01	93.
1.01	2.10	26	.01	0.00	.01	0.	1.01	14.10	170	.31	.30	.01	100.
1.01	2.15	27	.01	0.00	.01	0.	1.01	14.15	171	.31	.30	.00	106.
1.01	2.20	28	.01	.00	.01	0.	1.01	14.20	172	.31	.30	.00	110.
1.01	2.25	29	.01	.00	.01	0.	1.01	14.25	173	.31	.30	.00	112.
1.01	2.30	30	.01	.00	.01	0.	1.01	14.30	174	.31	.30	.00	114.
1.01	2.35	31	.01	.00	.01	0.	1.01	14.35	175	.31	.30	.00	114.
1.01	2.40	32	.01	.00	.01	0.	1.01	14.40	176	.31	.30	.00	115.
1.01	2.45	33	.01	.00	.01	0.	1.01	14.45	177	.31	.30	.00	115.
1.01	2.50	34	.01	.00	.01	0.	1.01	14.50	178	.31	.30	.00	115.
1.01	2.55	35	.01	.00	.01	0.	1.01	14.55	179	.31	.30	.00	115.
1.01	3.00	36	.01	.00	.01	0.	1.01	15.00	180	.31	.30	.00	115.
1.01	3.05	37	.01	.00	.01	0.	1.01	15.05	181	.19	.18	.00	111.
1.01	3.10	38	.01	.00	.01	1.	1.01	15.10	182	.37	.37	.00	105.
1.01	3.15	39	.01	.00	.01	1.	1.01	15.15	183	.37	.37	.00	112.
1.01	3.20	40	.01	.00	.01	1.	1.01	15.20	184	.56	.56	.01	130.
1.01	3.25	41	.01	.00	.01	1.	1.01	15.25	185	.65	.65	.01	160.
1.01	3.30	42	.01	.00	.01	1.	1.01	15.30	186	1.59	1.58	.01	225.
1.01	3.35	43	.01	.00	.01	1.	1.01	15.35	187	2.62	2.60	.02	379.
1.01	3.40	44	.01	.00	.01	1.	1.01	15.40	188	1.03	1.02	.01	543.
1.01	3.45	45	.01	.00	.01	1.	1.01	15.45	189	.65	.65	.00	545.
1.01	3.50	46	.01	.00	.01	1.	1.01	15.50	190	.56	.56	.00	439.
1.01	3.55	47	.01	.00	.01	1.	1.01	15.55	191	.37	.37	.00	332.
1.01	4.00	48	.01	.00	.01	1.	1.01	16.00	192	.37	.37	.00	254.
1.01	4.05	49	.01	.00	.01	1.	1.01	16.05	193	.29	.29	.00	199.
1.01	4.10	50	.01	.00	.01	1.	1.01	16.10	194	.29	.29	.00	161.
1.01	4.15	51	.01	.00	.01	1.	1.01	16.15	195	.29	.29	.00	137.
1.01	4.20	52	.01	.00	.01	1.	1.01	16.20	196	.29	.29	.00	123.
1.01	4.25	53	.01	.00	.01	1.	1.01	16.25	197	.29	.29	.00	116.
1.01	4.30	54	.01	.00	.01	1.	1.01	16.30	198	.29	.29	.00	112.
1.01	4.35	55	.01	.00	.01	1.	1.01	16.35	199	.29	.29	.00	110.
1.01	4.40	56	.01	.00	.01	1.	1.01	16.40	200	.29	.29	.00	109.
1.01	4.45	57	.01	.00	.01	1.	1.01	16.45	201	.29	.29	.00	109.
1.01	4.50	58	.01	.00	.01	1.	1.01	16.50	202	.29	.29	.00	108.
1.01	4.55	59	.01	.00	.01	1.	1.01	16.55	203	.29	.29	.00	108.
1.01	5.00	60	.01	.00	.01	2.	1.01	17.00	204	.29	.29	.00	108.

PLATE D-6

1.01	5.05	61	.01	.00	.01	2.	1.01	17.05	205	.23	.22	.00	106.
1.01	5.10	62	.01	.00	.01	2.	1.01	17.10	206	.23	.22	.00	100.
1.01	5.15	63	.01	.00	.01	2.	1.01	17.15	207	.23	.22	.00	94.
1.01	5.20	64	.01	.00	.01	2.	1.01	17.20	208	.23	.22	.00	90.
1.01	5.25	65	.01	.00	.01	2.	1.01	17.25	209	.23	.22	.00	87.
1.01	5.30	66	.01	.00	.01	2.	1.01	17.30	210	.23	.22	.00	86.
1.01	5.35	67	.01	.00	.01	2.	1.01	17.35	211	.23	.22	.00	86.
1.01	5.40	68	.01	.00	.01	2.	1.01	17.40	212	.23	.22	.00	86.
1.01	5.45	69	.01	.00	.01	2.	1.01	17.45	213	.23	.22	.00	85.
1.01	5.50	70	.01	.01	.01	2.	1.01	17.50	214	.23	.22	.00	85.
1.01	5.55	71	.01	.01	.01	2.	1.01	17.55	215	.23	.22	.00	85.
1.01	6.00	72	.01	.01	.01	2.	1.01	18.00	216	.23	.22	.00	85.
1.01	6.05	73	.06	.03	.03	3.	1.01	18.05	217	.02	.02	.00	78.
1.01	6.10	74	.06	.03	.03	5.	1.01	18.10	218	.02	.02	.00	57.
1.01	6.15	75	.06	.03	.03	8.	1.01	18.15	219	.02	.02	.00	35.
1.01	6.20	76	.06	.03	.03	10.	1.01	18.20	220	.02	.02	.00	21.
1.01	6.25	77	.06	.04	.03	11.	1.01	18.25	221	.02	.02	.00	15.
1.01	6.30	78	.06	.04	.03	12.	1.01	18.30	222	.02	.02	.00	11.
1.01	6.35	79	.06	.04	.03	13.	1.01	18.35	223	.02	.02	.00	9.
1.01	6.40	80	.06	.04	.02	14.	1.01	18.40	224	.02	.02	.00	8.
1.01	6.45	81	.06	.04	.02	14.	1.01	18.45	225	.02	.02	.00	7.
1.01	6.50	82	.06	.04	.02	15.	1.01	18.50	226	.02	.02	.00	7.
1.01	6.55	83	.06	.04	.02	15.	1.01	18.55	227	.02	.02	.00	7.
1.01	7.00	84	.06	.04	.02	16.	1.01	19.00	228	.02	.02	.00	7.
1.01	7.05	85	.06	.04	.02	16.	1.01	19.05	229	.02	.02	.00	7.
1.01	7.10	86	.06	.05	.02	16.	1.01	19.10	230	.02	.02	.00	7.
1.01	7.15	87	.06	.05	.02	17.	1.01	19.15	231	.02	.02	.00	7.
1.01	7.20	88	.06	.05	.02	17.	1.01	19.20	232	.02	.02	.00	7.
1.01	7.25	89	.06	.05	.02	17.	1.01	19.25	233	.02	.02	.00	7.
1.01	7.30	90	.06	.05	.02	18.	1.01	19.30	234	.02	.02	.00	7.
1.01	7.35	91	.06	.05	.02	18.	1.01	19.35	235	.02	.02	.00	7.
1.01	7.40	92	.06	.05	.01	18.	1.01	19.40	236	.02	.02	.00	7.
1.01	7.45	93	.06	.05	.01	18.	1.01	19.45	237	.02	.02	.00	7.
1.01	7.50	94	.06	.05	.01	19.	1.01	19.50	238	.02	.02	.00	7.
1.01	7.55	95	.06	.05	.01	19.	1.01	19.55	239	.02	.02	.00	7.
1.01	8.00	96	.06	.05	.01	19.	1.01	20.00	240	.02	.02	.00	7.
1.01	8.05	97	.06	.05	.01	19.	1.01	20.05	241	.02	.02	.00	7.
1.01	8.10	98	.06	.05	.01	19.	1.01	20.10	242	.02	.02	.00	7.
1.01	8.15	99	.06	.05	.01	19.	1.01	20.15	243	.02	.02	.00	7.
1.01	8.20	100	.06	.05	.01	20.	1.01	20.20	244	.02	.02	.00	7.
1.01	8.25	101	.06	.05	.01	20.	1.01	20.25	245	.02	.02	.00	7.
1.01	8.30	102	.06	.05	.01	20.	1.01	20.30	246	.02	.02	.00	7.
1.01	8.35	103	.06	.05	.01	20.	1.01	20.35	247	.02	.02	.00	7.
1.01	8.40	104	.06	.05	.01	20.	1.01	20.40	248	.02	.02	.00	7.
1.01	8.45	105	.06	.05	.01	20.	1.01	20.45	249	.02	.02	.00	7.
1.01	8.50	106	.06	.05	.01	20.	1.01	20.50	250	.02	.02	.00	7.
1.01	8.55	107	.06	.05	.01	21.	1.01	20.55	251	.02	.02	.00	7.
1.01	9.00	108	.06	.05	.01	21.	1.01	21.00	252	.02	.02	.00	7.
1.01	9.05	109	.06	.06	.01	21.	1.01	21.05	253	.02	.02	.00	7.
1.01	9.10	110	.06	.06	.01	21.	1.01	21.10	254	.02	.02	.00	7.
1.01	9.15	111	.06	.06	.01	21.	1.01	21.15	255	.02	.02	.00	7.
1.01	9.20	112	.06	.06	.01	21.	1.01	21.20	256	.02	.02	.00	7.
1.01	9.25	113	.06	.06	.01	21.	1.01	21.25	257	.02	.02	.00	7.
1.01	9.30	114	.06	.06	.01	21.	1.01	21.30	258	.02	.02	.00	7.
1.01	9.35	115	.06	.06	.01	21.	1.01	21.35	259	.02	.02	.00	7.
1.01	9.40	116	.06	.06	.01	21.	1.01	21.40	260	.02	.02	.00	7.
1.01	9.45	117	.06	.06	.01	21.	1.01	21.45	261	.02	.02	.00	7.
1.01	9.50	118	.06	.06	.01	21.	1.01	21.50	262	.02	.02	.00	7.
1.01	9.55	119	.06	.06	.01	22.	1.01	21.55	263	.02	.02	.00	7.
1.01	10.00	120	.06	.06	.01	22.	1.01	22.00	264	.02	.02	.00	7.
1.01	10.05	121	.06	.06	.01	22.	1.01	22.05	265	.02	.02	.00	7.
1.01	10.10	122	.06	.06	.01	22.	1.01	22.10	266	.02	.02	.00	7.

1.01	10.15	123	.06	.06	.01	22.	1.01	22.15	267	.02	.02	.00	7.
1.01	10.20	124	.06	.06	.01	22.	1.01	22.20	268	.02	.02	.00	7.
1.01	10.25	125	.06	.06	.01	22.	1.01	22.25	269	.02	.02	.00	7.
1.01	10.30	126	.06	.06	.01	22.	1.01	22.30	270	.02	.02	.00	7.
1.01	10.35	127	.06	.06	.01	22.	1.01	22.35	271	.02	.02	.00	7.
1.01	10.40	128	.06	.06	.01	22.	1.01	22.40	272	.02	.02	.00	7.
1.01	10.45	129	.06	.06	.01	22.	1.01	22.45	273	.02	.02	.00	7.
1.01	10.50	130	.06	.06	.00	22.	1.01	22.50	274	.02	.02	.00	7.
1.01	10.55	131	.06	.06	.00	22.	1.01	22.55	275	.02	.02	.00	7.
1.01	11.00	132	.06	.06	.00	22.	1.01	23.00	276	.02	.02	.00	7.
1.01	11.05	133	.06	.06	.00	22.	1.01	23.05	277	.02	.02	.00	7.
1.01	11.10	134	.06	.06	.00	22.	1.01	23.10	278	.02	.02	.00	7.
1.01	11.15	135	.06	.06	.00	22.	1.01	23.15	279	.02	.02	.00	7.
1.01	11.20	136	.06	.06	.00	22.	1.01	23.20	280	.02	.02	.00	7.
1.01	11.25	137	.06	.06	.00	22.	1.01	23.25	281	.02	.02	.00	7.
1.01	11.30	138	.06	.06	.00	22.	1.01	23.30	282	.02	.02	.00	7.
1.01	11.35	139	.06	.06	.00	22.	1.01	23.35	283	.02	.02	.00	7.
1.01	11.40	140	.06	.06	.00	23.	1.01	23.40	284	.02	.02	.00	7.
1.01	11.45	141	.06	.06	.00	23.	1.01	23.45	285	.02	.02	.00	7.
1.01	11.50	142	.06	.06	.00	23.	1.01	23.50	286	.02	.02	.00	7.
1.01	11.55	143	.06	.06	.00	23.	1.01	23.55	287	.02	.02	.00	7.
1.01	12.00	144	.06	.06	.00	23.	1.02	0.00	288	.02	.02	.00	7.
									SUM	31.33	29.46	1.87	11164.
										(796.)(	748.)(	48.)(	316.)(

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	545.	127.	39.	39.	11153.
CMS	15.	4.	1.	1.	316.
INCHES		24.05	29.41	29.41	29.41
MM		610.89	746.95	746.95	746.95
AC-FT		63.	77.	77.	77.
THOUS CU M		77.	95.	95.	95.

HYDROGRAPH AT STA0CC001 FOR PLAN 1, RTIO 1

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	272.	63.	19.	19.	5577.
CMS	8.	2.	1.	1.	158.
INCHES		12.03	14.70	14.70	14.70
MM		305.45	373.47	373.47	373.47
AC-FT		31.	38.	38.	38.
THOUS CU M		39.	47.	47.	47.

HYDROGRAPH AT STA0CC001 FOR PLAN 1, RTIO 2

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	327.	76.	23.	23.	6692.
CMS	9.	2.	1.	1.	189.
INCHES		14.43	17.64	17.64	17.64
MM		366.54	448.17	448.17	448.17
AC-FT		38.	46.	46.	46.
THOUS CU M		46.	57.	57.	57.

HYDROGRAPH AT STACCC001 FOR PLAN 1, RTIO 3

CMS	15.	3.	1.	1.	300.
INCHES		22.85	27.94	27.94	27.94
MM		580.35	709.60	709.60	709.60
AC-FT		60.	73.	73.	73.
THOUS CU M		74.	90.	90.	90.

HYDROGRAPH AT STACCC001 FOR PLAN 1, RTIO 9

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	545.	127.	39.	39.	11153.
CMS	15.	4.	1.	1.	316.
INCHES		24.05	29.41	29.41	29.41
MM		610.89	746.95	746.95	746.95
AC-FT		63.	77.	77.	77.
THOUS CU M		77.	95.	95.	95.

********** ********** ********** ********** **********

HYDROGRAPH ROUTING

ROUTED FLOWS THRU RESERVOIR 11608

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
000002	1	0	0	2	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-1018.	-1

STAGE	1018.00	1018.50	1019.10	1019.70	1020.50	1021.00	1022.00	1023.00	1024.00	1025.00
FLOW	0.00	28.90	140.30	327.40	737.80	1084.00	1912.00	2988.00	4227.00	5606.00
SURFACE AREA=	0.	4.	6.	15.						
CAPACITY=	0.	32.	45.	245.						
ELEVATION=	995.	1018.	1020.	1040.						

CREL	SPWID	COQW	EXPW	ELEVL	COQL	CAREA	EXPL
1018.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COQD	EXPD	DAMWID
1019.7	2.9	1.5	425.

CREST LENGTH AT OR BELOW ELEVATION	0.	52.	195.	360.	420.	425.	425.	425.
	1019.7	1019.9	1020.0	1020.2	1020.4	1020.6	1021.0	1025.0

STATION 000002, PLAN 1, RATIO 1 0.60 PMF

END-OF-PERIOD HYDROGRAPH ORDINATES

PLATE D-9

OUTFLOW

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	C.	0.	0.	0.
0.	0.	0.	0.	0.	0.	C.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	C.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	2.	2.	2.	3.
3.	3.	4.	4.	4.	5.	5.	5.	6.	6.
6.	6.	7.	7.	7.	7.	7.	8.	8.	8.
8.	8.	8.	8.	9.	9.	9.	9.	9.	9.
9.	9.	9.	10.	10.	10.	10.	10.	10.	10.
10.	10.	10.	10.	10.	10.	10.	10.	11.	11.
11.	11.	11.	11.	11.	11.	11.	11.	11.	11.
11.	11.	11.	11.	11.	12.	13.	14.	15.	17.
17.	20.	21.	22.	24.	25.	26.	27.	28.	29.
33.	35.	38.	39.	41.	42.	43.	43.	44.	45.
46.	48.	50.	51.	53.	54.	54.	55.	56.	56.
56.	56.	55.	57.	60.	68.	87.	118.	157.	187.
139.	175.	154.	135.	122.	110.	99.	90.	82.	76.
71.	68.	65.	62.	60.	58.	56.	54.	52.	50.
43.	47.	46.	45.	45.	44.	43.	41.	37.	32.
29.	27.	25.	23.	22.	20.	19.	18.	17.	16.
15.	14.	13.	12.	12.	11.	10.	10.	9.	9.
8.	8.	8.	7.	7.	7.	6.	6.	6.	6.
6.	5.	5.	5.	5.	5.	5.	5.	4.	4.
4.	4.	4.	4.	4.	4.	4.	4.	4.	4.
4.	4.	4.	4.	4.	4.	4.	4.	4.	4.
4.	4.	4.	4.	4.	4.	4.	4.		

STORAGE

34.	34.	34.	34.	34.	34.	34.	34.	34.	34.
34.	34.	34.	34.	34.	34.	34.	34.	34.	34.
34.	34.	34.	34.	34.	34.	34.	34.	34.	34.
34.	34.	34.	34.	34.	34.	34.	34.	34.	34.
34.	34.	34.	34.	34.	34.	34.	34.	34.	34.
34.	34.	34.	34.	34.	34.	34.	34.	34.	34.
34.	34.	34.	34.	34.	34.	34.	34.	34.	34.
34.	34.	34.	34.	34.	34.	34.	34.	34.	34.
34.	34.	34.	34.	34.	34.	34.	35.	35.	35.
35.	35.	35.	35.	35.	35.	35.	35.	35.	35.
35.	35.	35.	35.	35.	35.	35.	35.	35.	35.
35.	35.	35.	35.	35.	35.	35.	35.	35.	35.
35.	35.	35.	35.	35.	35.	35.	35.	35.	35.
35.	35.	35.	35.	35.	35.	35.	35.	35.	35.
35.	35.	35.	35.	35.	35.	35.	35.	35.	35.
36.	36.	36.	36.	36.	36.	36.	36.	36.	36.
37.	37.	37.	37.	37.	37.	37.	37.	37.	37.
37.	37.	37.	37.	37.	37.	37.	37.	37.	37.
37.	37.	37.	37.	37.	38.	38.	39.	40.	40.
40.	40.	40.	39.	39.	39.	38.	38.	38.	38.
38.	37.	37.	37.	37.	37.	37.	37.	37.	37.
37.	37.	37.	37.	37.	37.	37.	37.	37.	37.
36.	36.	36.	36.	36.	36.	36.	36.	35.	35.
35.	35.	35.	35.	35.	35.	35.	35.	35.	35.
35.	35.	35.	35.	35.	35.	35.	35.	35.	35.
[illegible]	35.	34.	34.	34.	34.	34.	34.	34.	34.
34.	34.	34.	34.	34.	34.	34.	34.	34.	34.
34.	34.	34.	34.	34.	34.	34.	34.	34.	34.
34.	34.	34.	34.	34.	34.	34.	34.		

PLATE D-10

STAGE

1018.0	1018.0	1018.0	1018.0	1018.0	1018.0	1018.0	1018.0	1018.0	1018.0
1018.0	1018.0	1018.0	1018.0	1018.0	1018.0	1018.0	1018.0	1018.0	1018.0
1018.0	1018.0	1018.0	1018.0	1018.0	1018.0	1018.0	1018.0	1018.0	1018.0
1018.0	1018.0	1018.0	1018.0	1018.0	1018.0	1018.0	1018.0	1018.0	1018.0
1018.0	1018.0	1018.0	1018.0	1018.0	1018.0	1018.0	1018.0	1018.0	1018.0
1018.0	1018.0	1018.0	1018.0	1018.0	1018.0	1018.0	1018.0	1018.0	1018.0
1018.0	1018.0	1018.0	1018.0	1018.0	1018.0	1018.0	1018.0	1018.0	1018.0
1018.0	1018.0	1018.0	1018.0	1018.0	1018.0	1018.0	1018.0	1018.0	1018.0
1018.1	1018.1	1018.1	1018.1	1018.1	1018.1	1018.1	1018.1	1018.1	1018.1
1018.1	1018.1	1018.1	1018.1	1018.1	1018.1	1018.1	1018.1	1018.1	1018.1
1018.1	1018.1	1018.1	1018.1	1018.1	1018.2	1018.2	1018.2	1018.2	1018.2
1018.2	1018.2	1018.2	1018.2	1018.2	1018.2	1018.2	1018.2	1018.2	1018.2
1018.2	1018.2	1018.2	1018.2	1018.2	1018.2	1018.2	1018.2	1018.2	1018.2
1018.2	1018.2	1018.2	1018.2	1018.2	1018.2	1018.2	1018.2	1018.2	1018.2
1018.2	1018.2	1018.2	1018.2	1018.2	1018.2	1018.2	1018.2	1018.3	1018.3
1018.3	1018.3	1018.4	1018.4	1018.4	1018.4	1018.4	1018.5	1018.5	1018.5
1018.5	1018.5	1018.5	1018.6	1018.6	1018.6	1018.6	1018.6	1018.6	1018.6
1018.6	1018.6	1018.6	1018.6	1018.6	1018.6	1018.6	1018.6	1018.6	1018.6
1018.6	1018.6	1018.6	1018.6	1018.7	1018.7	1018.8	1019.0	1019.2	1019.2
1019.3	1019.2	1019.1	1019.1	1019.0	1018.9	1018.9	1018.8	1018.8	1018.8
1018.7	1018.7	1018.7	1018.7	1018.7	1018.7	1018.6	1018.6	1018.6	1018.6
1018.6	1018.6	1018.6	1018.6	1018.6	1018.6	1018.6	1018.6	1018.5	1018.5
1018.5	1018.5	1018.4	1018.4	1018.4	1018.4	1018.3	1018.3	1018.3	1018.3
1018.3	1018.2	1018.2	1018.2	1018.2	1018.2	1018.2	1018.2	1018.2	1018.2
1018.1	1018.1	1018.1	1018.1	1018.1	1018.1	1018.1	1018.1	1018.1	1018.1
1018.1	1018.1	1018.1	1018.1	1018.1	1018.1	1018.1	1018.1	1018.1	1018.1
1018.1	1018.1	1018.1	1018.1	1018.1	1018.1	1018.1	1018.1	1018.1	1018.1
1018.1	1018.1	1018.1	1018.1	1018.1	1018.1	1018.1	1018.1	1018.1	1018.1
1018.1	1018.1	1018.1	1018.1	1018.1	1018.1	1018.1	1018.1		

PEAK OUTFLOW IS 189. AT TIME 15.92 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	189.	61.	19.	19.	5537.
CMS	5.	2.	1.	1.	157.
INCHES		11.57	14.60	14.60	14.60
MM		293.99	370.83	370.83	370.83
AC-FT		30.	38.	38.	38.
THOUS CU M		37.	47.	47.	47.

STATION CC0002

INFLOW(I), OUTFLOW(O) AND OBSERVED FLOW(*)

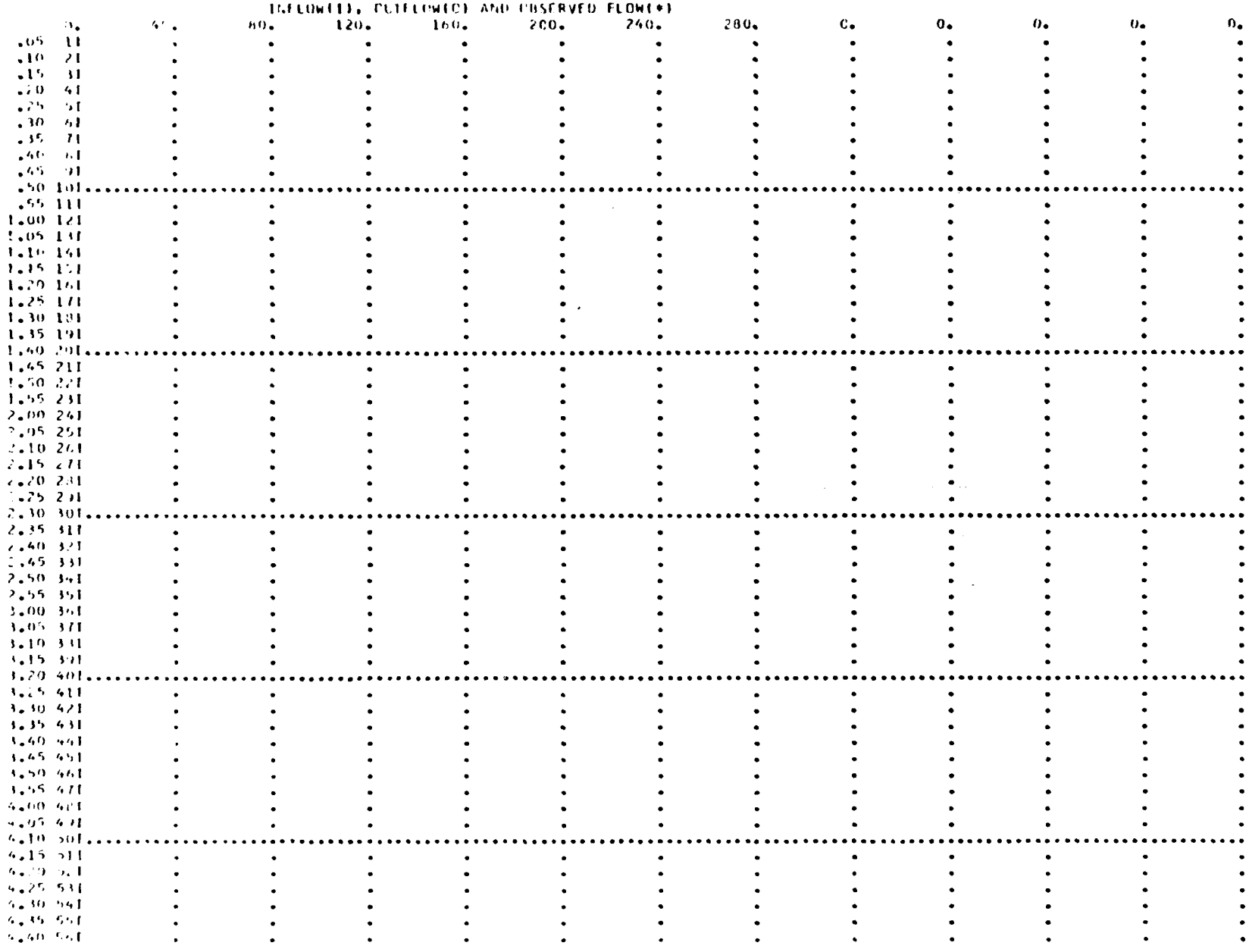


PLATE D-12

PLATE D-13

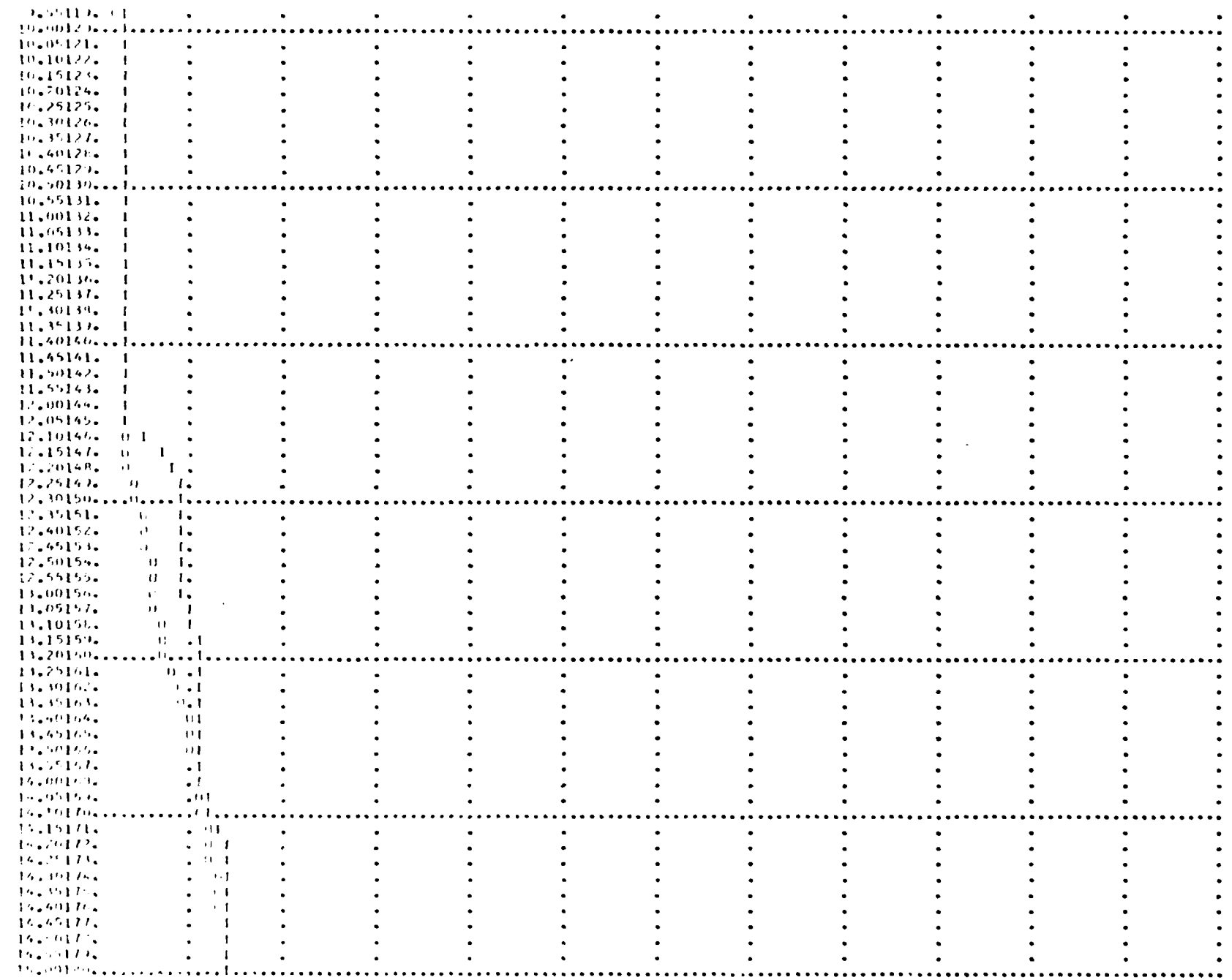


PLATE D-14

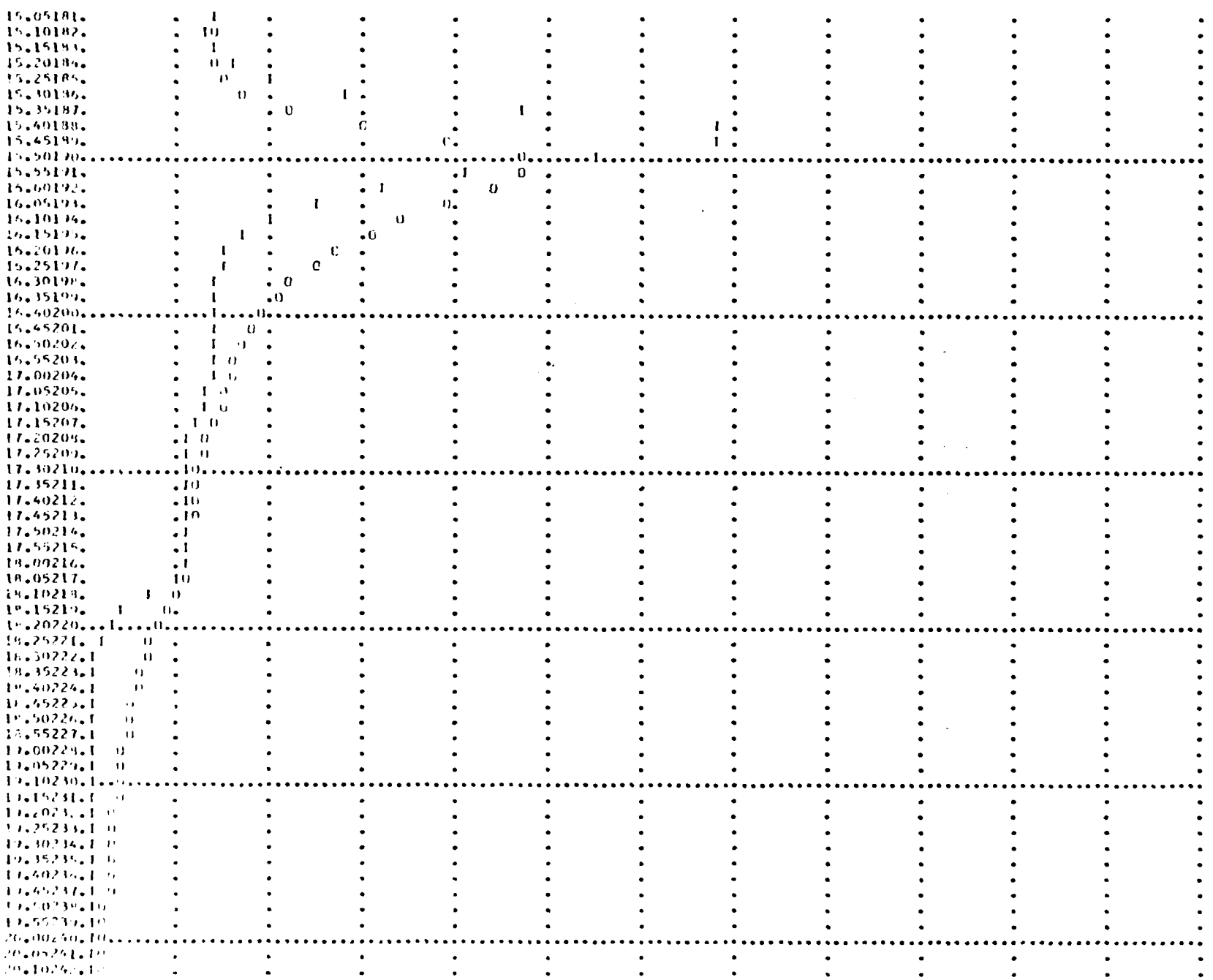


PLATE D-15

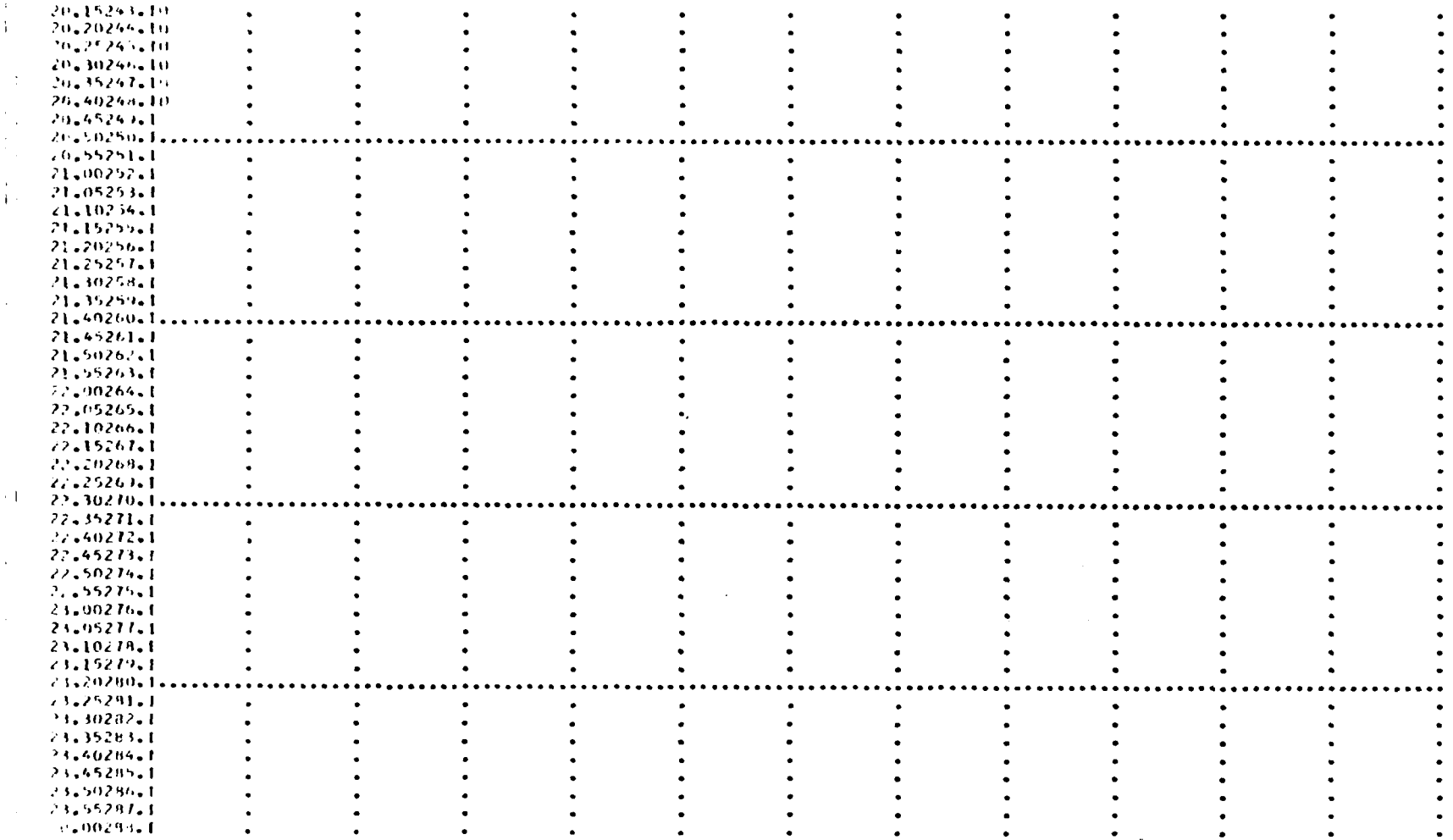


PLATE D-16

STATION 060002, PLAN 1, RATIO 9 PMF

END-OF-PERIOD HYDROGRAPH ORDINATES

OUTFLOW

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	2.	2.	2.	3.	3.	4.	5.	5.
6.	7.	8.	8.	9.	9.	10.	11.	11.	12.
12.	13.	13.	14.	14.	14.	15.	15.	15.	16.
16.	16.	17.	17.	17.	17.	18.	18.	18.	18.
19.	19.	19.	19.	19.	19.	20.	20.	20.	20.
20.	20.	20.	20.	21.	21.	21.	21.	21.	21.
21.	21.	21.	21.	21.	22.	22.	22.	22.	22.
22.	22.	22.	22.	22.	23.	25.	28.	34.	42.
49.	55.	59.	62.	65.	67.	69.	71.	74.	77.
79.	81.	83.	85.	86.	87.	88.	89.	90.	91.
94.	97.	100.	103.	105.	107.	109.	110.	111.	112.
112.	111.	111.	113.	120.	135.	188.	277.	378.	434.
419.	353.	305.	265.	228.	196.	171.	152.	139.	133.
128.	124.	121.	118.	116.	113.	110.	106.	102.	99.
96.	94.	92.	91.	89.	88.	87.	83.	75.	64.
56.	45.	37.	30.	28.	26.	25.	23.	22.	21.
20.	19.	18.	17.	16.	15.	15.	14.	14.	13.
13.	12.	12.	11.	11.	11.	10.	10.	10.	10.
9.	9.	9.	9.	9.	8.	8.	8.	8.	8.
8.	8.	8.	8.	8.	8.	7.	7.	7.	7.
7.	7.	7.	7.	7.	7.	7.	7.	7.	7.
7.	7.	7.	7.	7.	7.	7.	7.		

STORAGE

34.	34.	34.	34.	34.	34.	34.	34.	34.	34.
34.	34.	34.	34.	34.	34.	34.	34.	34.	34.
34.	34.	34.	34.	34.	34.	34.	34.	34.	34.
34.	34.	34.	34.	34.	34.	34.	34.	34.	34.
34.	34.	34.	34.	34.	34.	34.	34.	34.	34.
34.	34.	34.	34.	34.	34.	34.	34.	34.	34.
34.	34.	34.	34.	34.	34.	34.	34.	34.	34.
34.	34.	34.	34.	34.	34.	34.	34.	34.	35.
35.	35.	35.	35.	35.	35.	35.	35.	35.	35.
35.	35.	35.	35.	35.	35.	35.	35.	35.	35.
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36.	36.	36.	36.	36.	36.	36.	36.	36.	36.
36.	36.	36.	36.	36.	36.	36.	36.	36.	36.
36.	36.	36.	36.	36.	36.	36.	36.	36.	36.
36.	36.	36.	36.	36.	36.	36.	36.	37.	37.
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44.	44.	42.	42.	41.	40.	40.	40.	39.	39.
39.	39.	39.	39.	39.	39.	39.	39.	38.	38.
38.	38.	38.	38.	38.	38.	38.	38.	38.	37.
37.	37.	37.	36.	36.	36.	36.	36.	36.	36.
36.	36.	36.	36.	36.	36.	36.	36.	35.	35.

PLATE D-17

35.	35.	35.	35.	35.	35.	35.	35.	35.	35.
35.	35.	35.	35.	35.	35.	35.	35.	35.	35.
35.	35.	35.	35.	35.	35.	35.	35.	35.	35.
35.	35.	35.	35.	35.	35.	35.	35.	35.	35.
35.	35.	35.	35.	35.	35.	35.	35.		

STAGE

1018.0	1018.0	1018.0	1018.0	1018.0	1018.0	1018.0	1018.0	1018.0	1018.0
1018.0	1018.0	1018.0	1018.0	1018.0	1018.0	1018.0	1018.0	1018.0	1018.0
1018.0	1018.0	1018.0	1018.0	1018.0	1018.0	1018.0	1018.0	1018.0	1018.0
1018.0	1018.0	1018.0	1018.0	1018.0	1018.0	1018.0	1018.0	1018.0	1018.0
1018.0	1018.0	1018.0	1018.0	1018.0	1018.0	1018.0	1018.0	1018.0	1018.0
1018.0	1018.0	1018.0	1018.0	1018.0	1018.0	1018.0	1018.0	1018.0	1018.0
1018.0	1018.0	1018.0	1018.0	1018.0	1018.0	1018.0	1018.0	1018.0	1018.0
1018.0	1018.0	1018.0	1018.0	1018.0	1018.0	1018.1	1018.1	1018.1	1018.1
1018.1	1018.1	1018.1	1018.1	1018.2	1018.2	1018.2	1018.2	1018.2	1018.2
1018.2	1018.2	1018.2	1018.2	1018.2	1018.2	1018.3	1018.3	1018.3	1018.3
1018.3	1018.3	1018.3	1018.3	1018.3	1018.3	1018.3	1018.3	1018.3	1018.3
1018.3	1018.3	1018.3	1018.3	1018.3	1018.3	1018.3	1018.3	1018.3	1018.3
1018.3	1018.3	1018.4	1018.4	1018.4	1018.4	1018.4	1018.4	1018.4	1018.4
1018.4	1018.4	1018.4	1018.4	1018.4	1018.4	1018.4	1018.4	1018.4	1018.4
1018.4	1018.4	1018.4	1018.4	1018.4	1018.4	1018.4	1018.5	1018.5	1018.6
1018.6	1018.6	1018.7	1018.7	1018.7	1018.7	1018.7	1018.7	1018.7	1018.8
1018.8	1018.8	1018.8	1018.8	1018.8	1018.8	1018.8	1018.8	1018.8	1018.8
1018.9	1018.9	1018.9	1018.9	1018.9	1018.9	1018.9	1018.9	1018.9	1018.9
1018.9	1018.9	1018.9	1019.0	1019.0	1019.1	1019.3	1019.5	1019.8	1019.9
1019.9	1019.8	1019.6	1019.5	1019.4	1019.3	1019.2	1019.1	1019.1	1019.1
1019.0	1019.0	1019.0	1019.0	1019.0	1019.0	1018.9	1018.9	1018.9	1018.9
1018.9	1018.9	1018.8	1018.8	1018.8	1018.8	1018.8	1018.8	1018.7	1018.7
1018.6	1018.6	1018.5	1018.5	1018.5	1018.5	1018.4	1018.4	1018.4	1018.4
1018.3	1018.3	1018.3	1018.3	1018.3	1018.3	1018.3	1018.2	1018.2	1018.2
1018.2	1018.2	1018.2	1018.2	1018.2	1018.2	1018.2	1018.2	1018.2	1018.2
1018.2	1018.2	1018.2	1018.2	1018.1	1018.1	1018.1	1018.1	1018.1	1018.1
1018.1	1018.1	1018.1	1018.1	1018.1	1018.1	1018.1	1018.1	1018.1	1018.1
1018.1	1018.1	1018.1	1018.1	1018.1	1018.1	1018.1	1018.1	1018.1	1018.1
1018.1	1018.1	1018.1	1018.1	1018.1	1018.1	1018.1	1018.1		

PEAK OUTFLOW IS 434. AT TIME 15.83 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	434.	125.	38.	38.	11076.
CMS	12.	4.	1.	1.	314.
INCHES		23.67	29.20	29.20	29.20
MM		601.21	741.76	741.76	741.76
AC-FT		62.	76.	76.	76.
THOUS CU M		76.	94.	94.	94.

STATION00002

INFLOW(I), OUTFLOW(O) AND OBSERVED FLOW(*)

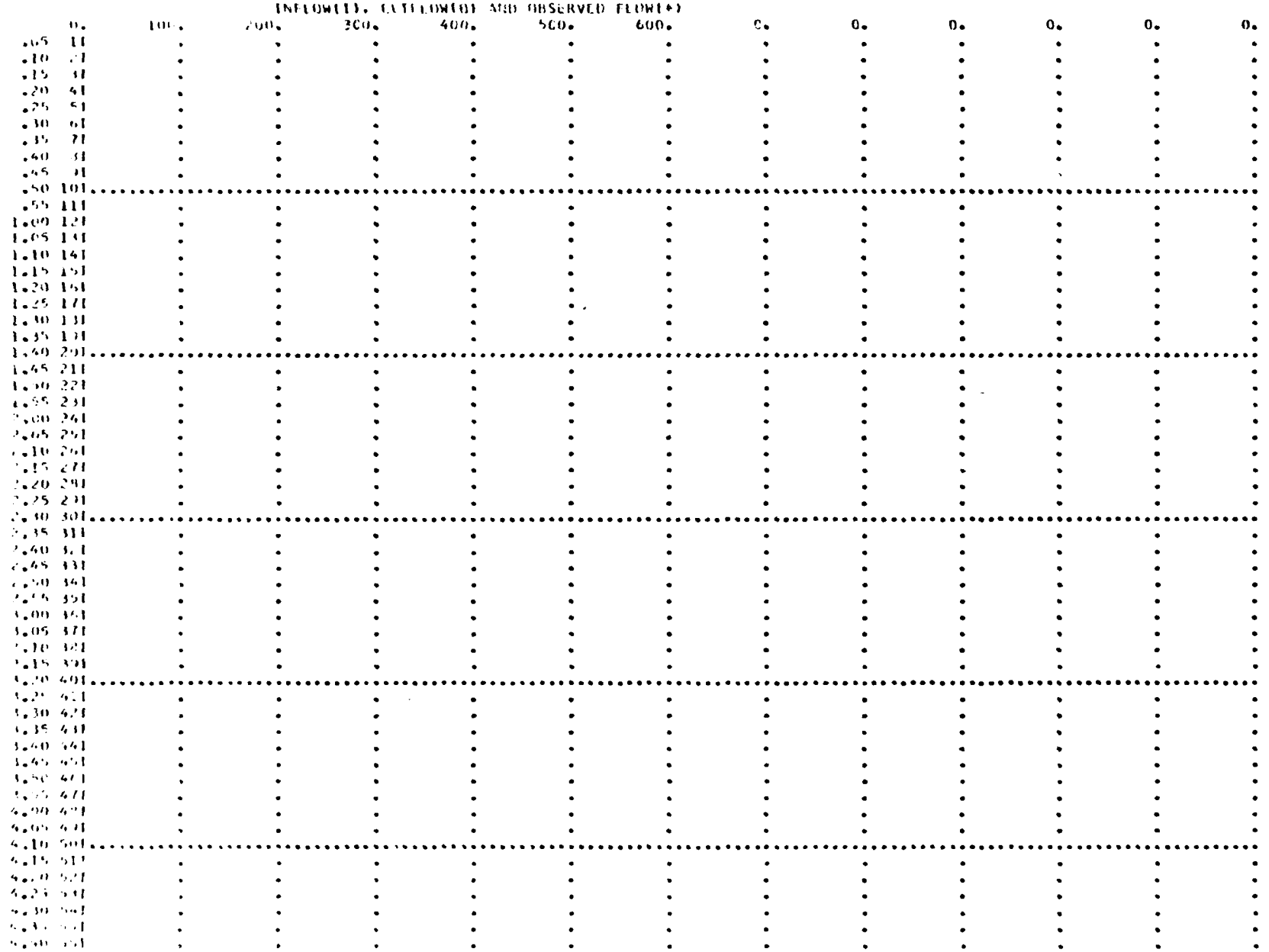


PLATE D-19

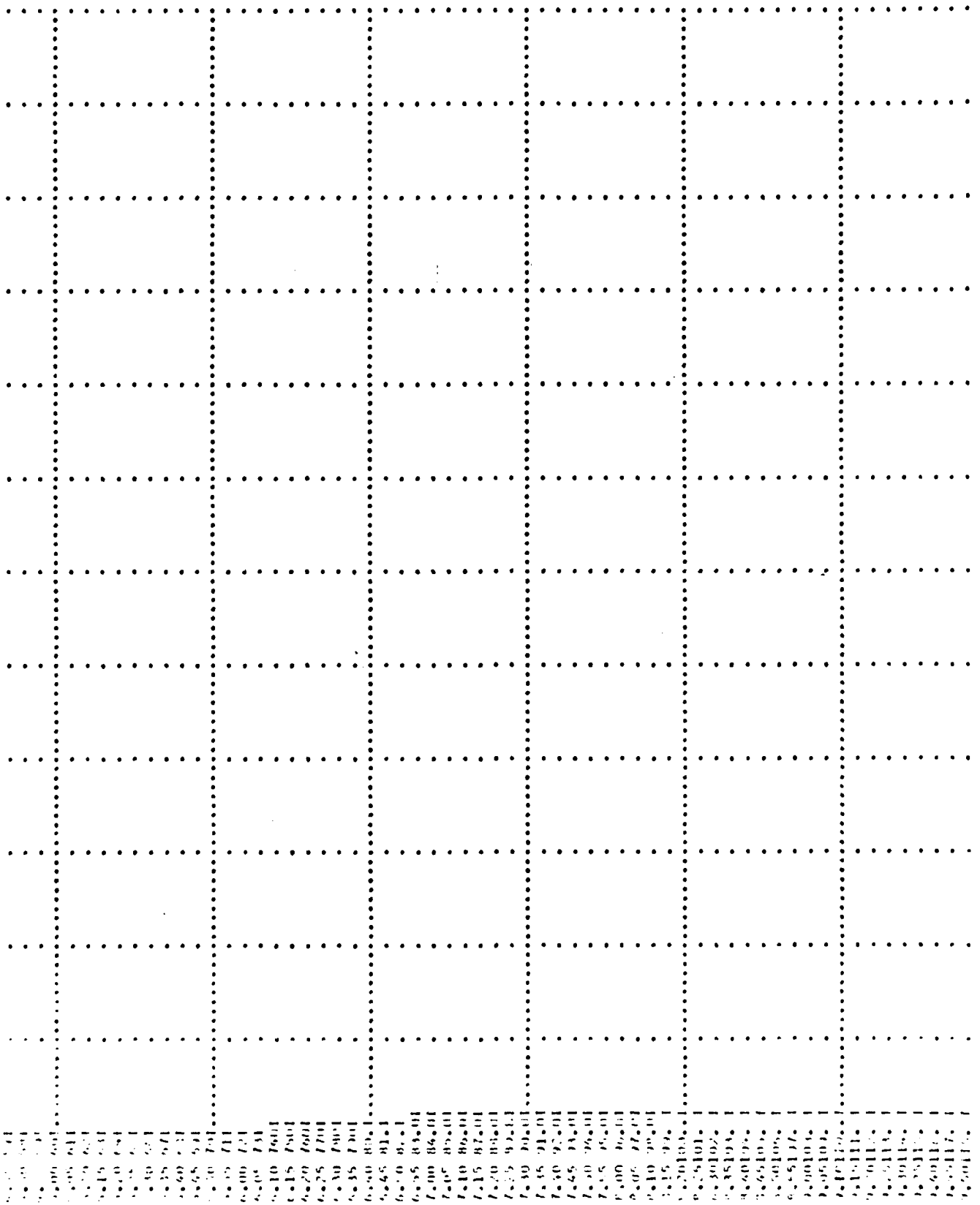


PLATE D-20

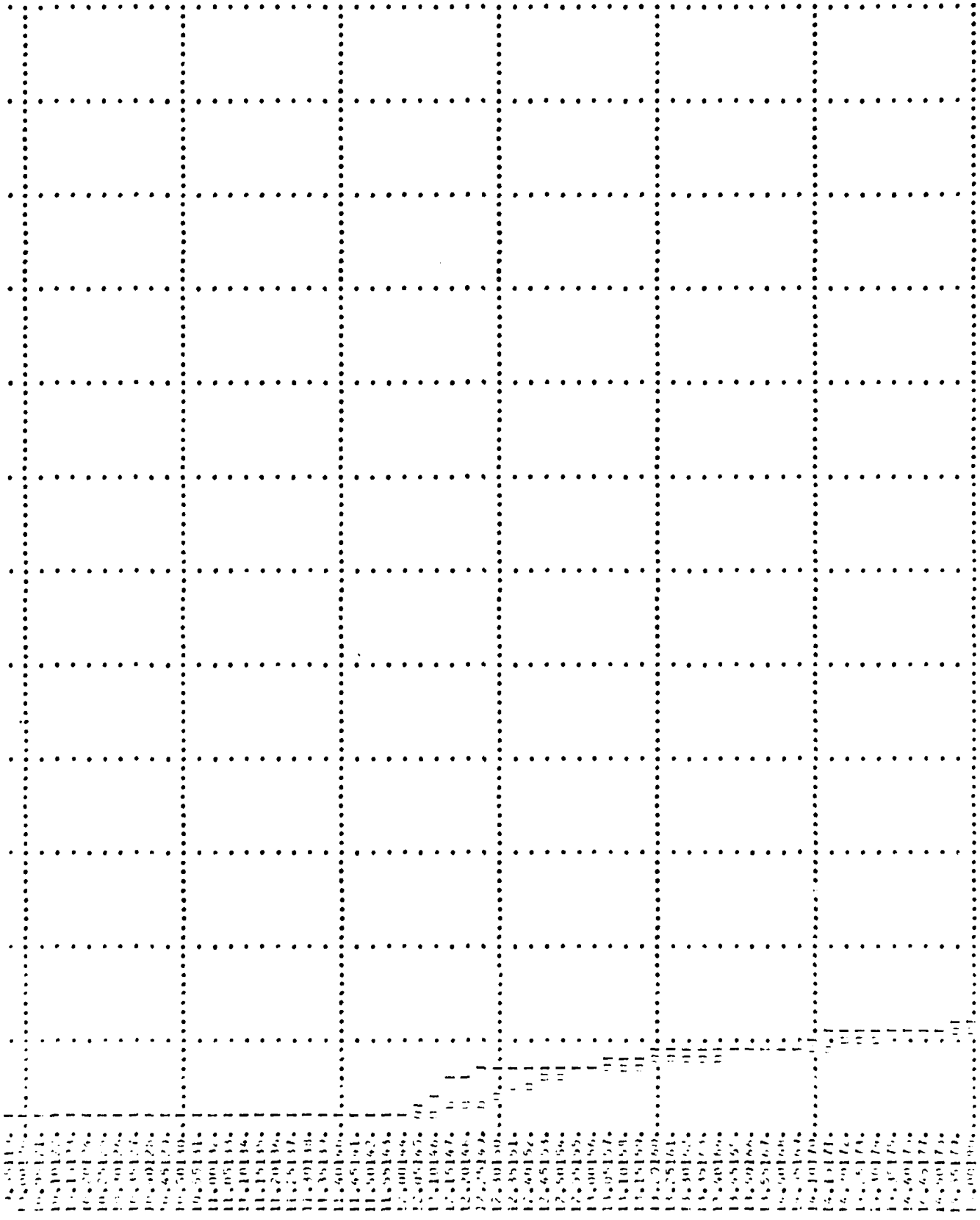


PLATE D-21

PLATE D-22

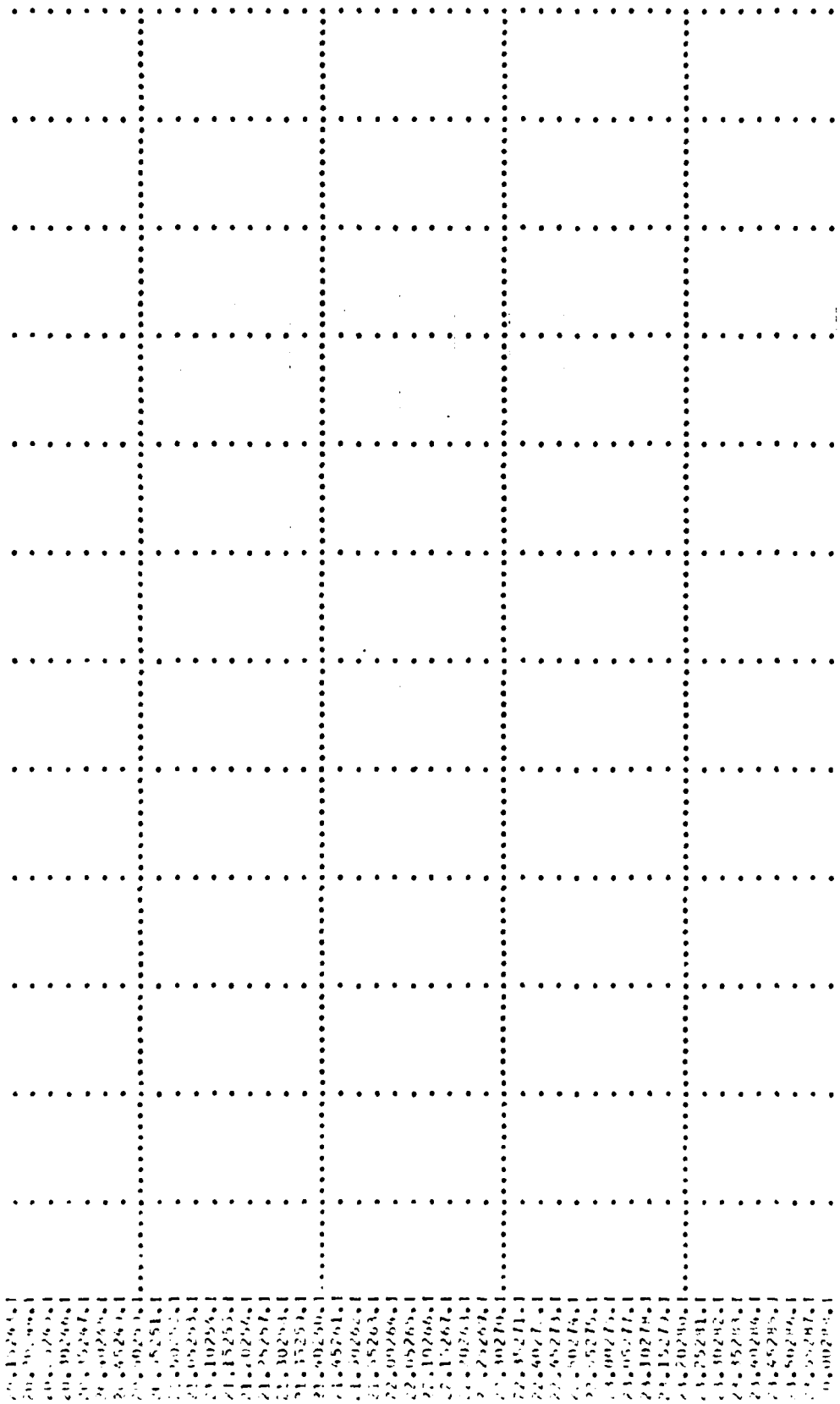


PLATE D-23

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIO 1 .50	RATIO 2 .60	RATIO 3 .70	RATIO 4 .75	RATIO 5 .80	RATIO 6 .85	RATIO 7 .90	RATIO 8 .95	RATIO 9 1.00
HYDROGRAPH AT	000001	.05	1	272.	327.	381.	408.	436.	463.	490.	517.	545.
	(	.13)	(	7.71)(	9.25)(	10.79)(	11.56)(	12.34)(	13.11)(	13.88)(	14.65)(	15.42)
ROUTED TO	000002	.05	1	189.	233.	276.	297.	319.	346.	377.	406.	434.
	(	.13)	(	5.34)(	6.59)(	7.81)(	8.42)(	9.03)(	9.79)(	10.67)(	11.49)(	12.28)

PLATE D-24

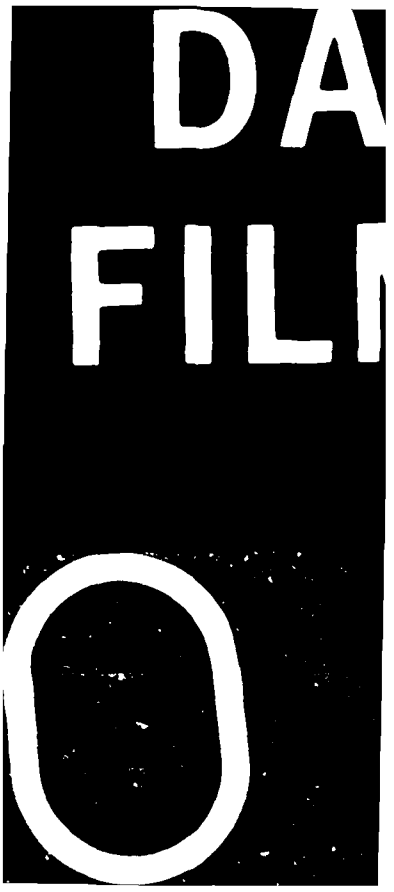
SUMMARY OF DAM SAFETY ANALYSIS

PLATE E .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1018.00	1018.00	1019.70
STORAGE	34.	34.	43.
OUTFLOW	0.	0.	327.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.50	1019.25	0.00	40.	189.	0.00	15.92	0.00
.60	1019.40	0.00	41.	233.	0.00	15.83	0.00
.70	1019.53	0.00	42.	276.	0.00	15.83	0.00
.75	1019.60	0.00	42.	297.	0.00	15.83	0.00
.80	1019.67	0.00	43.	319.	0.00	15.83	0.00
.85	1019.74	.04	43.	346.	.17	15.83	0.00
.90	1019.79	.09	43.	377.	.17	15.83	0.00
.95	1019.85	.15	44.	406.	.33	15.83	0.00
1.00	1019.90	.20	44.	434.	.33	15.83	0.00

PLATE D-25


DA
FIL